Fisher™ FIELDVUE™ DVC6000 HW2 Digital Valve Controller

This manual applies to

Instrument Level	HC, AD, PD, ODV
Device Type	130b
Device Revision	1 & 2
Hardware Revision	2
Firmware Revision	6
DD Revision	4 & 5

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The FIELDVUE DVC6000 HW2 digital valve controller is a core component of the PlantWeb™ digital plant architecture. The digital valve controller powers PlantWeb by capturing and delivering valve diagnostic data. Coupled with ValveLink™ software, the DVC6000 HW2 provides users with an accurate picture of valve performance, including actual stem position, instrument input signal, and pneumatic pressure to the actuator. Using this information, the digital valve controller diagnoses not only itself, but also the valve and actuator to which it is mounted.

Section 1 Introduction

Installation, Pneumatic and Electrical Connections, and Initial Configuration

Refer to the DVC6005 Series Remote Mount quick start guide (D103784X012) for DVC6000 HW2 installation, connection and initial configuration information. If a copy of this quick start guide is needed contact your Emerson Process Management sales office or visit our website at www.Fisher.com.

Scope of Manual

This instruction manual is a supplement to the DVC6005 Series Remote Mount quick start guide that ships with every instrument. This instruction manual includes product specifications, reference materials, custom setup information, maintenance procedures, and replacement part details.

This instruction manual describes using the 475 Field Communicator to set up and calibrate the instrument. You can also use Fisher ValveLink software or ValveLink Mobile software to setup, calibrate, and diagnose the valve and instrument. For information on using ValveLink software with the instrument refer to ValveLink software help or documentation.

Do not install, operate, or maintain a DVC6000 HW2 digital valve controller without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. **To avoid personal injury or property damage, it is important to carefully read, understand, and follow all of the contents of this manual, including all safety cautions and warnings.** If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.

Conventions Used in this Manual

Navigation paths and fast-key sequences are included for procedures and parameters that can be accessed using the Field Communicator.

For example, to access Device Setup:

Field Communicator	Configure > Guided Setup > Device Setup (2-1-1)

Refer to Appendix B for Field Communicator menu trees.

Description

DVC6000 HW2 digital valve controllers (figures 1-1) are communicating, microprocessor-based current-to-pneumatic instruments. In addition to the normal function of converting an input current signal to a pneumatic output pressure, the DVC6000 HW2 digital valve controller, using the HART® communications protocol, gives easy access to information critical to process operation. You can gain information from the principal component of the process, the control valve itself, using the Field Communicator at the valve, or at a field junction box, or by using a personal computer or operator's console within the control room.

Using a personal computer and ValveLink software or AMS Suite: Intelligent Device Manager, or a Field Communicator, you can perform several operations with the DVC6000 HW2 digital valve controller. You can obtain general information concerning software revision level, messages, tag, descriptor, and date.

Diagnostic information is available to aid you when troubleshooting. Input and output configuration parameters can be set, and the digital valve controller can be calibrated. Refer to table 1-1 for details on the capabilities of each diagnostic tier.

Using the HART protocol, information from the field can be integrated into control systems or be received on a single loop basis.

The DVC6000 HW2 digital valve controller is designed to directly replace standard pneumatic and electro-pneumatic valve mounted positioners.

Figure 1-1. DVC6000 HW2 Digital Valve Controller Mounted on Rotary Control Valve/Actuator

W8373

Table 1-1. Instrument Level Capabilities

CAPABILITY	DIAGNOSTIC LEVEL(2)			
	HC	AD	PD	ODV
Auto Calibration	X	X	X	X
Custom Characterization	X	X	X	X
Burst Communication	X	X	X	X
Alerts	X	X	X	X
Step Response, Drive Signal Test & Dynamic Error Band		X	X	X
Advanced Diagnostics (Valve Signature)		X	X	X
Performance Tuner		X	X	X
Travel Control - Pressure Fallback		X	X	X
Supply Pressure Sensor		X	X	X
Performance Diagnostics			X	X
Solenoid Valve Testing			X	X
Lead/Lag Set Point Filter(1)				X

1. Refer to brochure part # D351146X012/D351146X412 for information on Fisher optimized digital valves for compressor antisurge applications.
2. HC = HART Communicating ; AD = Advanced Diagnostics ; PD = Performance Diagnostics ; ODV = Optimized Digital Valve.

Specifications

⚠ WARNING

Refer to table 1-2 for specifications. Incorrect configuration of a positioning instrument could result in the malfunction of the product, property damage or personal injury.

Specifications for DVC6000 HW2 digital valve controllers are shown in table 1-2. Specifications for the Field Communicator can be found in the product manual for the Field Communicator.

Table 1-2. Specifications

Available Mounting

DVC6000 HW2 digital valve controllers can be mounted on Fisher and other manufacturers rotary and sliding-stem actuators(1)

DVC6005 HW2: Base unit for 2 inch pipestand or wall mounting

■ DVC6015: Remotely mounted feedback unit for sliding-stem applications
■ DVC6025: Remotely mounted feedback unit for rotary or long-stroke sliding-stem applications or
■ DVC6035: Remotely mounted feedback unit for quarter-turn rotary applications

Mounting kit required for mounting feedback unit on actuator

Mounting the instrument vertically, with the vent at the bottom of the assembly, or horizontally, with the vent pointing down, is recommended to allow drainage of moisture that may be introduced via the instrument air supply.

Communication Protocol

■ HART 5 or ■ HART 7

Input Signal

Point-to-Point
Analog Input Signal: 4-20 mA DC, nominal; split ranging available
Minimum Voltage Available at Instrument Terminals must be 9.5 VDC for analog control, 10 VDC for HART communication
Minimum Control Current: 4.0 mA
Minimum Current w/o Microprocessor Restart: 3.5 mA
Maximum Voltage: 30 VDC
Overcurrent protected
Reverse Polarity protected

Multi-drop
Instrument Power: 11 to 30 VDC at 10 mA
Reverse Polarity protected

Supply Pressure(2)

Minimum Recommended: 0.3 bar (5 psig) higher than maximum actuator requirements
Maximum: 10.0 bar (145 psig) or maximum pressure rating of the actuator, whichever is lower

Medium: Air or Natural Gas

Supply medium must be clean, dry and non-corrosive

Per ISA Standard 7.0.01: A maximum 40 micrometer particle size in the air system is acceptable. Further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimized.

Per ISO 8573-1:
Maximum particle density size: Class 7
Oil content: Class 3
Pressure Dew Point: Class 3 or at least 10°C less than the lowest ambient temperature expected

Output Signal

Pneumatic signal as required by the actuator, up to full supply pressure.
Minimum Span: 0.4 bar (6 psig)
Maximum Span: 9.5 bar (140 psig)
Action: ■ Double, ■ Single Direct or ■ Reverse

Steady-State Air Consumption(3)(4)

Standard Relay
At 1.4 bar (20 psig) supply pressure:
Less than 0.38 normal m^3/hr (14 scfh)
At 5.5 bar (80 psig) supply pressure:
Less than 1.3 normal m^3/hr (49 scfh)

Low Bleed Relay
At 1.4 bar (20 psig) supply pressure:
Average value 0.056 normal m^3/hr (2.1 scfh)
At 5.5 bar (80 psig) supply pressure:
Average value 0.184 normal m^3/hr (6.9 scfh)

Maximum Output Capacity(3)(4)

At 1.4 bar (20 psig) supply pressure:
10.0 normal m^3/hr (375 scfh)
At 5.5 bar (80 psig) supply pressure:
29.5 normal m^3/hr (1100 scfh)

Operating Ambient Temperature Limits(2)(5)

-40 to 85°C (-40 to 185°F) for base unit
-52 to 85°C (-62 to 185°F) for base unit utilizing the Extreme Temperature option (fluorosilicone elastomers)
-52 to 125°C (-62 to 257°F) for remote-mount feedback unit

Independent Linearity(6)

Typical Value: ±0.50% of output span

-continued-

Table 1-2. Specifications (continued)

Electromagnetic Compatibility

Meets EN 61326-1:2013
Immunity—Industrial locations per Table 2 of the EN 61326-1 standard. Performance is shown in table 1-3 below.
Emissions—Class A
ISM equipment rating: Group 1, Class A

Lightning and Surge Protection—The degree of immunity to lightning is specified as Surge immunity in table 1-3. For additional surge protection commercially available transient protection devices can be used.

Vibration Testing Method

Tested per ANSI/ISA-S75.13.01 Section 5.3.5. A resonant frequency search is performed on all three axes. The instrument is subjected to the ISA specified 1/2 hour endurance test at each major resonance.

Input Impedance

An equivalent impedance of 500 ohms may be used. This value corresponds to 10V @ 20 mA.

Humidity Testing Method

Tested per IEC 61514-2

Electrical Classification

Hazardous Area Approvals

CSA— Intrinsically Safe, Explosion-proof, Division 2, Dust Ignition-proof

FM— Intrinsically Safe, Explosion-proof, Dust Ignition-proof, Non-Incendive

ATEX— Intrinsically Safe, Flameproof, Type n

IECEx— Intrinsically Safe, Flameproof, Type n

Electrical Housing

CSA— Type 4X, IP66

FM— Type 4X, IP66

ATEX— IP66

IECEx— IP66

Other Classifications/Certifications

CUTR—Customs Union Technical Regulations (Russia, Kazakhstan, Belarus, and Armenia)

INMETRO— National Institute of Metrology, Quality, and Technology (Brazil)

PESO CCOE— Petroleum and Explosives Safety Organisation - Chief Controller of Explosives (India)

Contact your Emerson Process Management sales office for classification/certification specific information.

Connections

Supply Pressure: 1/4 NPT internal and integral pad for mounting 67CFR regulator
Output Pressure: 1/4 NPT internal
Tubing: 3/8-inch recommended
Vent: 3/8 NPT internal
Electrical: 1/2 NPT internal or M20(7)

Actuator Compatibility

Stem Travel (Sliding-Stem Linear)
Linear Actuators with rated travel between 6.35 mm (0.25 inch) and 606 mm (23.375 inches)

Shaft Rotation (Quarter-Turn Rotary)
Rotary Actuators with rated travel between 50 degrees and 180 degrees

Mounting

Weight

DVC6005 HW2 Base Unit: 4.1 kg (9 lbs)

DVC6015 Remote Feedback Unit: 1.3 kg (2.9 lbs)
DVC6025 Remote Feedback Unit: 1.4 kg (3.1 lbs)
DVC6035 Remote Feedback Unit: 0.9 kg (2.0 lbs)

Construction Materials

Housing, module base and terminal box:
A03600 low copper aluminum alloy
Cover: Thermoplastic polyester
Elastomers: Nitrile (standard)
Fluorosilicone (extreme temperature)

Options

■ Supply and output pressure gauges or
■ Tire valves ■ Integral mounted filter regulator
■ Low-Bleed Relay ■ Extreme Temperature

■ **Integral 4-20 mA Position Transmitter(8):**
4-20 mA output, isolated
Supply Voltage: 8-30 VDC
Fault Indication: offrange high or low
Reference Accuracy: 1% of travel span

(Options continued on next page)

-continued-

Table 1-2. Specifications (continued)

Options (continued)	**Declaration of SEP**
■ Integral Switch(8): One isolated switch, configurable throughout the calibrated travel range or actuated from a device alert *Off State:* 0 mA (nominal) *On State:* up to 1 A *Supply Voltage:* 30 VDC maximum *Reference Accuracy:* 2% of travel span Contact your Emerson Process Management sales office, or go to www.FIELDVUE.com for additional information	Fisher Controls International LLC declares this product to be in compliance with Article 3 paragraph 3 of the Pressure Equipment Directive (PED) 97 / 23 / EC. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance. However, the product *may* bear the CE marking to indicate compliance with *other* applicable European Community Directives.

NOTE: Specialized instrument terms are defined in ANSI/ISA Standard 51.1 - Process Instrument Terminology.
1. 4-conductor shielded cable, 18 to 22 AWG minimum wire size, in rigid or flexible metal conduit, is required for connection between base unit and feedback unit. Pneumatic tubing between base unit output connection and actuator has been tested to 91 meters (300 feet). At 15 meters (50 feet) there was no performance degradation. At 91 meters there was minimal pneumatic lag.
2. The pressure/temperature limits in this document and any other applicable code or standard should not be exceeded.
3. Normal m^3/hour - Normal cubic meters per hour at 0°C and 1.01325 bar, absolute. Scfh - Standard cubic feet per hour at 60°F and 14.7 psia.
4. Values at 1.4 bar (20 psig) based on a single-acting direct relay; values at 5.5 bar (80 psig) based on double-acting relay.
5. Temperature limits vary based on hazardous area approval.
6. Not applicable for travels less than 19 mm (0.75 inch) or for shaft rotation less than 60 degrees. Also not applicable for digital valve controllers in long-stroke applications.
7. M20 electrical connection only available with ATEX approvals
8. The electronic output is available with either the position transmitter or the switch.

Table 1-3. EMC Summary Results—Immunity

Port	Phenomenon	Basic Standard	Test Level	Performance Criteria(1)	
				Point-to-Point Mode	Multi-drop Mode
Enclosure	Electrostatic discharge (ESD)	IEC 61000-4-2	4 kV contact 8 kV air	A(2)	A
	Radiated EM field	IEC 61000-4-3	80 to 1000 MHz @ 10V/m with 1 kHz AM at 80% 1400 to 2000 MHz @ 3V/m with 1 kHz AM at 80% 2000 to 2700 MHz @ 1V/m with 1 kHz AM at 80%	A	A
	Rated power frequency magnetic field	IEC 61000-4-8	30 A/m at 50/60Hz	A(2)	A
I/O signal/control	Burst	IEC 61000-4-4	1 kV	A	A
	Surge	IEC 61000-4-5	1 kV	B	B
	Conducted RF	IEC 61000-4-6	150 kHz to 80 MHz at 3 Vrms	A	A

Performance criteria: +/- 1% effect.
1. A = No degradation during testing. B = Temporary degradation during testing, but is self-recovering.
2. Excluding auxiliary switch function, which meets Performance Criteria B.

Related Documents

This section lists other documents containing information related to the DVC6000 HW2 digital valve controller. These documents include:

- Bulletin 62.1:DVC6000 HW2 - Fisher FIELDVUE DVC6000 HW2 Digital Valve Controller (D103786X012)
- Bulletin 62.1:DVC6005 - Fisher FIELDVUE DVC6005 Series Digital Valve Controller and DVC6015, DVC6025, and DVC6035 Feedback Unit Dimension (D103308X012)
- Fisher FIELDVUE DVC6005 Series Remote Mount Digital Valve Controller Quick Start Guide (D103784X012)
- FIELDVUE Digital Valve Controller Split Ranging (D103262X012)
- Using FIELDVUE Instruments with the Smart HART Loop Interface and Monitor (HIM) (D103263X012)

- Using FIELDVUE Instruments with the Smart Wireless THUM™ Adapter and a HART Interface Module (HIM) (D103469X012)
- Audio Monitor for HART Communications (D103265X012)
- HART Field Device Specification - Fisher FIELDVUE DVC6000 HW2 Digital Valve Controller (D103782X012)
- Using the HART Tri-Loop HART-to-Analog Signal Converter with FIELDVUE Digital Valve Controllers (D103267X012)
- Lock-in-Last Strategy (D103261X012)
- Fisher HF340 Filter Instruction Manual (D102796X012)
- 475 Field Communicator User's Manual
- ValveLink Software Help or Documentation

All documents are available from your Emerson Process Management sales office. Also visit our website at www.FIELDVUE.com.

Educational Services

For information on available courses for the DVC6000 HW2 digital valve controller, as well as a variety of other products, contact:

Emerson Process Management
Educational Services - Registration
Phone: + 1-641-754-3771 or +1-800-338-8158
Email: education@emerson.com
http://www.emersonprocess.com/education

Section 2 Wiring Practices

Control System Requirements

There are several parameters that should be checked to ensure the control system is compatible with the DVC6000 HW2 digital valve controller.

HART Filter

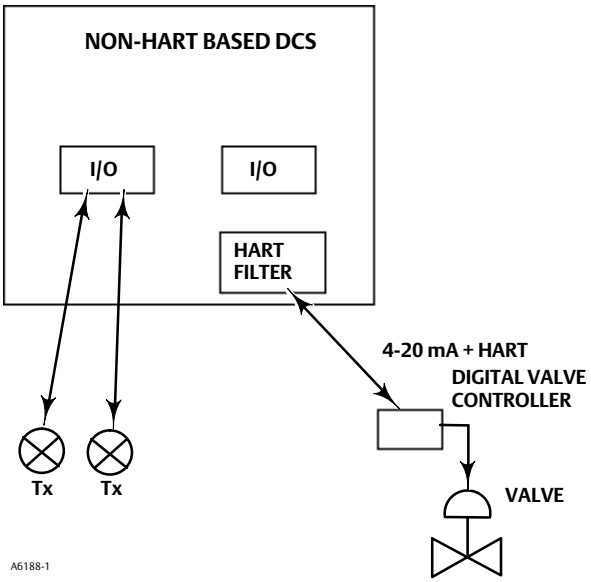
Depending on the control system you are using, a HART filter may be needed to allow HART communication. The HART filter is a passive device that is inserted in field wiring from the HART loop. The filter is normally installed near the field wiring terminals of the control system I/O (see figure 2-1). Its purpose is to effectively isolate the control system output from modulated HART communication signals and raise the impedance of the control system to allow HART communication. For more information on the description and use of the HART filter, refer to the appropriate HART filter instruction manual.

To determine if your system requires a filter contact your Emerson Process Management sales office.

Note

A HART filter is typically NOT required for any of the Emerson Process Management control systems, including PROVOX™, RS3™, and DeltaV™ systems.

Figure 2-1. HART Filter Application



Voltage Available

The voltage available at the DVC6000 HW2 digital valve controller must be at least 10 VDC. The voltage available at the instrument is not the actual voltage measured at the instrument when the instrument is connected. The voltage measured at the instrument is limited by the instrument and is typically less than the voltage available.

As shown in figure 2-2, the voltage available at the instrument depends upon:

- the control system compliance voltage
- if a filter, wireless THUM adapter, or intrinsic safety barrier is used, and
- the wire type and length.

The control system compliance voltage is the maximum voltage at the control system output terminals at which the control system can produce maximum loop current.

The voltage available at the instrument may be calculated from the following equation:

Voltage Available = [Control System Compliance Voltage (at maximum current)] - [filter voltage drop (if a HART filter is used)] - [total cable resistance $\times$ maximum current] - [barrier resistance x maximum current].

The calculated voltage available should be greater than or equal to 10 volts DC.

Table 2-1 lists the resistance of some typical cables.

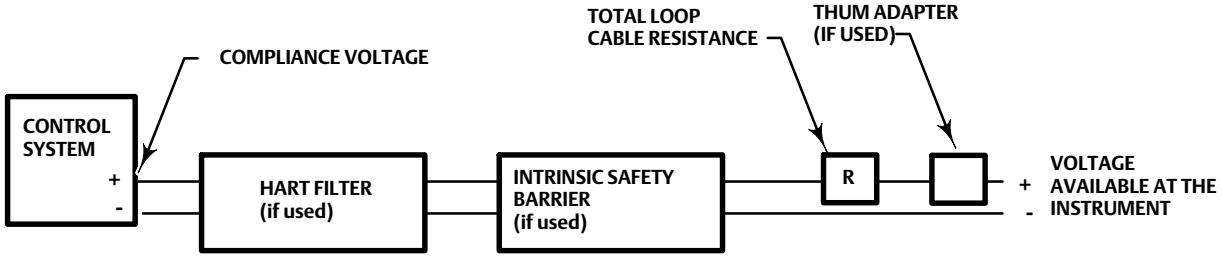
The following example shows how to calculate the voltage available for a Honeywell™ TDC2000 control system with a HF340 HART filter, and 1000 feet of Belden™ 9501 cable:

Voltage available = [18.5 volts (at 21.05 mA)] - [2.3 volts] - [48 ohms $\times$ 0.02105 amps]

Voltage available = [18.5] - [2.3] - [1.01]

Voltage available = 15.19 volts

Figure 2-2. Determining Voltage Available at the Instrument



Calculate Voltage Available at the Instrument as follows:	**Example Calculation**
Control system compliance voltage	**18.5 volts (at 21.05 mA)**
– Filter voltage drop (if used) 1	**– 2.3 volts (for HF300 filter)**
– Intrinsic safety barrier resistance (if used) x maximum loop current	**– 2.55 volts (121 ohms x 0.02105 amps)**
– Smart Wireless THUM adapter voltage drop (if used) 2	
– Total loop cable resistance x maximum loop current	**– 1.01 volts (48 ohms x 0.02105 amps for 1000 feet of Belden 9501 cable)**
= Voltage available at the instrument 3	**= 15.19 volts, available—if safety barrier (2.55 volts) is not used**

NOTES:

1 Obtain filter voltage drop. The measured drop will be different than this value. The measured filter voltage drop depends upon control system output voltage, the intrinsic safety barrier (if used), and the instrument. See note 3.

2 The voltage drop of the THUM adapter is linear from 2.25 volts at 3.5 mA to 1.2 volts at 25 mA.

3 The voltage available at the instrument is not the voltage measured at the instrument terminals. Once the instrument is connected, the instrument limits the measured voltage to approximately 8.0 to 9.5 volts.

Table 2-1. Cable Characteristics

Cable Type	Capacitance(1) pF/Ft	Capacitance(1) pF/m	Resistance(2) Ohms/ft	Resistance(2) Ohms/m
BS5308/1, 0.5 sq mm	61.0	200	0.022	0.074
BS5308/1, 1.0 sq mm	61.0	200	0.012	0.037
BS5308/1, 1.5 sq mm	61.0	200	0.008	0.025
BS5308/2, 0.5 sq mm	121.9	400	0.022	0.074
BS5308/2, 0.75 sq mm	121.9	400	0.016	0.053
BS5308/2, 1.5 sq mm	121.9	400	0.008	0.025
BELDEN 8303, 22 awg	63.0	206.7	0.030	0.098
BELDEN 8441, 22 awg	83.2	273	0.030	0.098
BELDEN 8767, 22 awg	76.8	252	0.030	0.098
BELDEN 8777, 22 awg	54.9	180	0.030	0.098
BELDEN 9501, 24 awg	50.0	164	0.048	0.157
BELDEN 9680, 24 awg	27.5	90.2	0.048	0.157
BELDEN 9729, 24 awg	22.1	72.5	0.048	0.157
BELDEN 9773, 18 awg	54.9	180	0.012	0.042
BELDEN 9829, 24 awg	27.1	88.9	0.048	0.157
BELDEN 9873, 20 awg	54.9	180	0.020	0.069

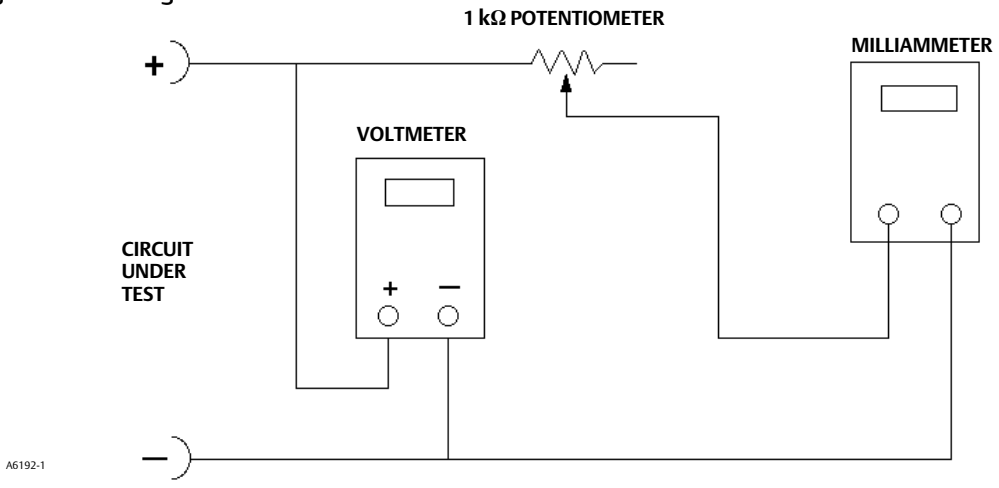
1. The capacitance values represent capacitance from one conductor to all other conductors and shield. This is the appropriate value to use in the cable length calculations.
2. The resistance values include both wires of the twisted pair.

Compliance Voltage

If the compliance voltage of the control system is not known, perform the following compliance voltage test.

1. Disconnect the field wiring from the control system and connect equipment as shown in figure 2-3 to the control system terminals.

Figure 2-3. Voltage Test Schematic



2. Set the control system to provide maximum output current.
3. Increase the resistance of the 1 kΩ potentiometer, shown in figure 2-3, until the current observed on the milliammeter begins to drop quickly.
4. Record the voltage shown on the voltmeter. This is the control system compliance voltage.

For specific parameter information relating to your control system, contact your Emerson Process Management sales office.

Auxiliary Terminal Wiring Length Guidelines

The Auxiliary Input Terminals of a DVC6000 HW2 with instrument level ODV can be used with a locally-mounted switch for initiating a partial stroke test. Some applications require that the switch be installed remotely from the DVC6000 HW2.

The length for wiring connected to the Auxiliary Input Terminals is limited by capacitance. For proper operation of the Auxiliary Input Terminals capacitance should not exceed 100,000 pF. As with all control signal wiring, good wiring practices should be observed to minimize adverse effect of electrical noise on the Aux Switch function.

Example Calculation: Capacitance per foot or per meter is required to calculate the length of wire that may be connected to the Aux switch input. The wire should not exceed the capacitance limit of 100,000 pF. Typically the wire manufacturer supplies a data sheet which provides all of the electrical properties of the wire. The pertinent parameter is the highest possible capacitance. If shielded wire is used, the appropriate number is the “Conductor to Other Conductor & Shield” value.

Example — 18AWG Unshielded Audio, Control and Instrumentation Cable

Manufacturer's specifications include:

Nom. Capacitance Conductor to Conductor @ 1 KHz: 26 pF/ft
Nom. Conductor DC Resistance @ 20 Deg. C: 5.96 Ohms/1000 ft
Max. Operating Voltage - UL 200 V RMS (PLTC, CMG),150 V RMS (ITC)
Allowable Length with this cable = 100,000pF /(26pF/ft) = 3846 ft

Example — 18AWG Shielded Audio, Control and Instrumentation Cable

Manufacturer's specifications include:

Nom. Characteristic Impedance: 29 Ohms
Nom. Inductance: .15 µH/ft
Nom. Capacitance Conductor to Conductor @ 1 KHz: 51 pF/ft
Nom. Cap. Cond. to other Cond. & Shield @ 1 Khz: 97 pF/ft
Allowable Length with this cable = 100,000pF /(97pF/ft) = 1030 ft

The AUX switch input passes less than 1 mA through the switch contacts, and uses less than 5 V, therefore, neither the resistance nor the voltage rating of the cable are critical. Ensure that switch contact corrosion is prevented. It is generally advisable that the switch have gold-plated or sealed contacts.

Maximum Cable Capacitance

The maximum cable length for HART communication is limited by the characteristic capacitance of the cable. Maximum length due to capacitance can be calculated using the following formulas:

Length(ft) = [160,000 - Cmaster(pF)] ÷ [Ccable(pF/ft)]

Length(m) = [160,000 - Cmaster(pF)] ÷ [Ccable(pF/m)]

where:

160,000 = a constant derived for FIELDVUE instruments to ensure that the HART network RC time constant will be no greater than 65 µs (per the HART specification).

Cmaster = the capacitance of the control system or HART filter

Ccable = the capacitance of the cable used (see table 2-1)

The following example shows how to calculate the cable length for a Foxboro™ I/A control system (1988) with a C_{master} of 50, 000 pF and a Belden 9501 cable with characteristic capacitance of 50pF/ft.

Length(ft) = [160,000 - 50,000pF] ÷ [50pF/ft]

Length = 2200 ft.

The HART communication cable length is limited by the cable characteristic capacitance. To increase cable length, select a wire with lower capacitance per foot. Contact your Emerson Process Management sales office for specific information relating to your control system.

Remote Travel Sensor Connections

The DVC6005 HW2 base unit is designed to receive travel information via a remote sensor. The remote can be any of the following:

- Emerson Process Management supplied DVC6015, DVC6025 or DVC6035 remote feedback unit; refer to the DVC6005 Series Remote Mount Digital Valve Controller quick start guide (D103784X012) that ships with the product,
- An under-traveled 10 kOhm potentiometer used in conjunction with onboard 30 kOhm resistor, or
- A potentiometer used in conjunction with two fixed resistors (potentiometer travel is the same as actuator travel).

⚠ WARNING

Personal injury or property damage, caused by wiring failure, can result if the feedback wiring connecting the base unit with the remote feedback unit shares a conduit with any other power or signal wiring.

Do not place feedback wiring in the same conduit as other power or signal wiring.

Note

3-conductor shielded cable, 22 AWG minimum wire size, is required for connection between base unit and feedback unit. Pneumatic tubing between base unit output connection and actuator has been tested to 91 meters (300 feet). At 15 meters (50 feet) there was no performance degradation. At 91 meters there was minimal pneumatic lag.

Using an External 10 kOhm External Potentiometer as a Remote Travel Sensor

Note

Potentiometer travel must be between 1.3 and 1.6 times greater than the actuator travel. For example: if an actuator has a travel of 9 inches, then a linear potentiometer must be selected with a rated travel between 11.7 and 14.4 inches. The resistive element must be tapered from 0 kOhm to 10 kOhm over rated travel of the potentiometer. The actuator will only use 63 to 76 % of the potentiometer rated travel.

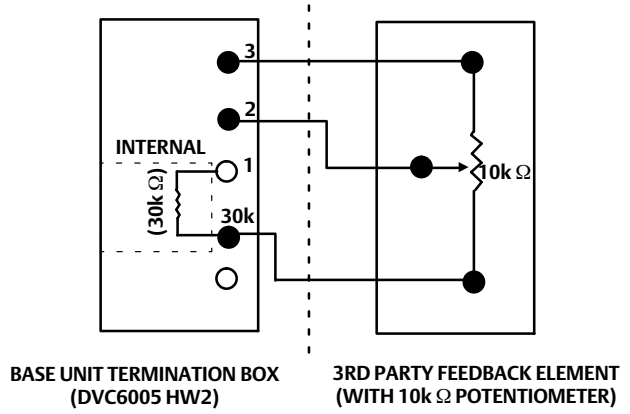
Note

The digital valve controller must be configured using the SStem/Roller selection on the menu of the appropriate setup device.

The DVC6005 HW2 base unit was designed to work with a 40 kOhm potentiometer for travel feedback. However, there are linear potentiometers that are readily available with a rated resistance of 10 kOhm. Therefore, the feedback connections terminal box of the DVC6005 HW2 contains an additional 30 kOhm fixed resistor that may be added to the circuit. This brings the total resistance up to the required 40 kOhm.

1. Mount the external 10 kOhm potentiometer to the actuator such that the mid-travel position of the potentiometer (5 kOhm) corresponds to the mid-travel position of the actuator. This will leave an equal amount of unused resistive element on both ends of the travel, which is required by the digital valve controller to function properly.
2. On the base unit, remove the feedback connections terminal box cap.
3. If necessary, install conduit between the potentiometer and the base unit following applicable local and national electrical codes. Route the 3-conductor shielded cable between the two units (refer to figure 2-4).

Figure 2-4. Terminal Details for Connecting a FIELDVUE DVC6005 HW2 Base Unit and a 10k Ohm External Potentiometer



4. Connect one wire of the 3-conductor shielded cable between the terminal labeled “30kΩ” on the base unit and one end lead of the potentiometer.
5. Connect the second wire of the 3-conductor shielded cable between the middle lead (wiper) of the 10 kOhm potentiometer to Terminal 2 on the base unit.
6. Connect the third wire of the 3-conductor shielded cable between Terminal 3 on the base unit and the other end-lead of the 10 kOhm potentiometer.
7. Connect the cable shield or drain wire to the ground screw in the feedback connections terminal box of the base unit. Do not connect the shield or drain wire to the external potentiometer.
8. Replace and tighten the base unit cover.

Using a Potentiometer with Two Fixed Resistors as a Remote Travel Sensor

Perform the following procedure if a potentiometer is used with the same, or slightly longer travel than the actuator's travel.

Note

The potentiometer must be capable of resistance close to 0 Ohms.

CAUTION

To prevent damage to the potentiometer, ensure that it is free to travel the entire length of the actuator's travel.

Note

The digital valve controller must be configured using the SStem/Roller selection on the menu of the appropriate setup device.

This procedure uses three resistors connected in series, two fixed resistors and one potentiometer. Three conditions must be met for the resistor combination to correctly operate the digital valve controller:

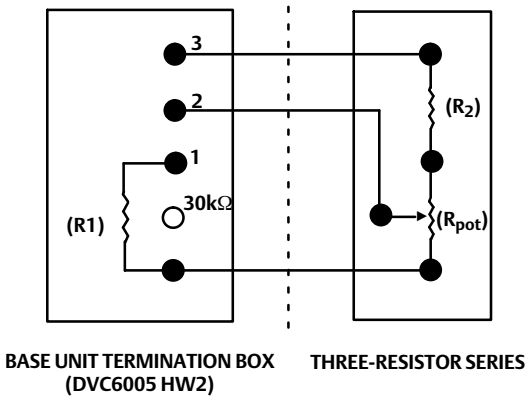
- The maximum resistance of the potentiometer [Rpot(max)] must be between 3.9 kOhm and 10 kOhm.
- The resistance of R_1 is 4.25 times greater than Rpot(max).
- The resistance of R_2 is 4 times less than Rpot(max).

⚠ WARNING

To avoid personal injury or property damage from an uncontrolled process ensure that the R1 resistor is properly insulated before installing it in the terminal box.

1. On the base unit, remove the feedback connections terminal box cap.
2. If necessary, install conduit between the two-resistor series and the base unit following applicable local and national electrical codes. Route the 3-conductor shielded cable between the two units (refer to figure 2-5).

Figure 2-5. Terminal Details for Connecting a FIELDVUE DVC6005 HW2 Base Unit and a Three-Resistor Series



3. Install the fixed resistor (R_1) across the unlabeled bottom Terminal and Terminal #1. The bottom terminal does not have a screw. The screw on the 30 kOhm terminal can be used. R1 must be properly insulated when installed in the terminal box to prevent personal injury or property damage.
4. Connect one wire of the 3-conductor shielded cable between the unlabeled bottom Terminal on the base unit and an end-lead of the external potentiometer (R_{pot}).
5. Connect the second wire of the 3-conductor shielded cable between the middle lead (wiper) of the external potentiometer (R_{pot}) and Terminal 2 on the base unit.
6. Connect the third wire of the 3-conductor shielded cable between between a lead on fixed resistor (R_2) and terminal #3 of the base unit.
7. Connect the available end-lead on the potentiometer (R_{pot}) with the available lead on fixed resistor (R_2).
8. Connect the cable shield or drain wire to the ground screw in the feedback connections terminal box of the base unit. Do not connect the shield or drain wire to the two-resistor series.
9. Replace and tighten the base unit cover.

Example: Using a linear potentiometer rated at 400 Ohms/inch on an actuator with 16” of travel.

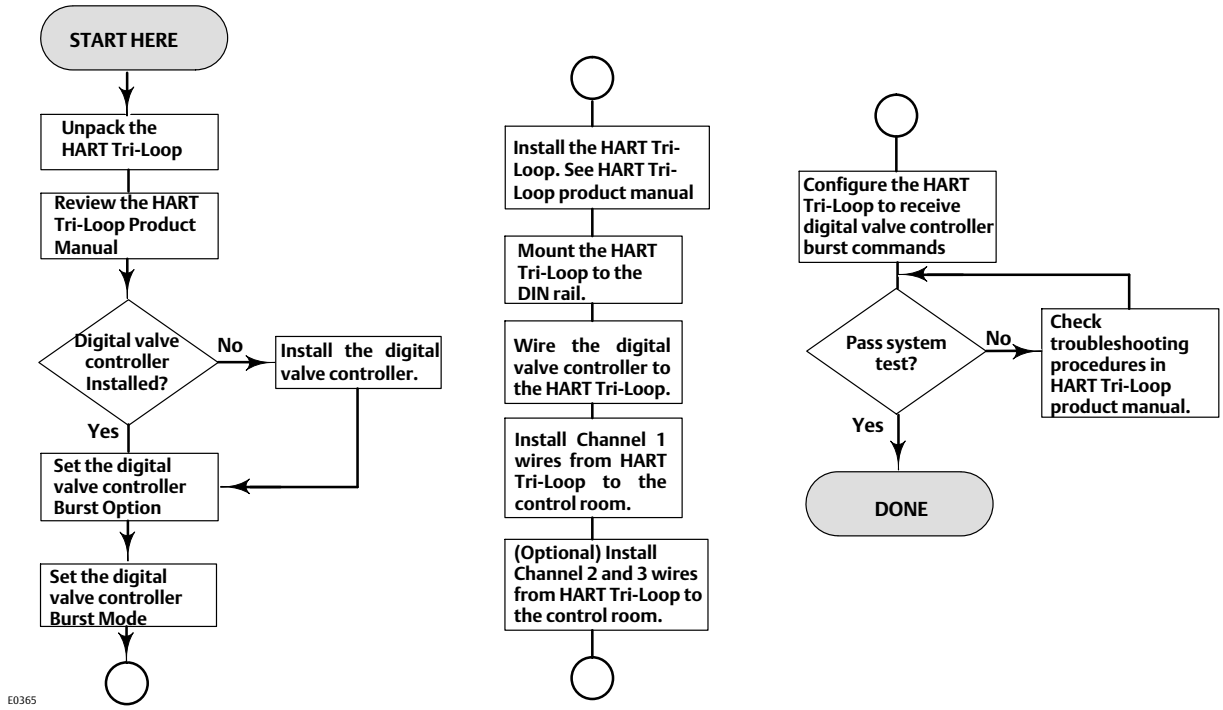
- $R_{pot(max)}$ is 400 Ohms/in x 16” = 6.4 kOhm
- R_1 = 6.4 kOhm x 4.25 = 27.2 kOhm
- R_2 = 6.4 kOhm / 4 = 1.6 kOhm

Installation in Conjunction with a Rosemount 333 HART Tri-Loop HART-to-Analog Signal Converter

Use the DVC6000 HW2 digital valve controller in operation with a Rosemount 333 HART Tri-Loop HART-to-Analog Signal Converter to acquire an independent 4-20 mA analog output signal for the analog input, travel target, pressure, or travel. The HART Tri-Loop accepts any three of these digital signals and converts them into three separate 4-20 mA analog channels.

Refer to figure 2-6 for basic installation information. Refer to the 333 HART Tri-Loop HART-to-Analog Signal Converter Product Manual for complete installation information.

Figure 2-6. HART Tri-Loop Installation Flowchart


START HERE
Unpack the HART Tri-Loop
Review the HART Tri-Loop Product Manual
Digital valve controller Installed?
No
Install the digital valve controller.
Yes
Set the digital valve controller Burst Option
Set the digital valve controller Burst Mode
E0365
Install the HART Tri-Loop. See HART Tri-Loop product manual
Mount the HART Tri-Loop to the DIN rail.
Wire the digital valve controller to the HART Tri-Loop.
Install Channel 1 wires from HART Tri-Loop to the control room.
(Optional) Install Channel 2 and 3 wires from HART Tri-Loop to the control room.
Configure the HART Tri-Loop to receive digital valve controller burst commands
Pass system test?
No
Check troubleshooting procedures in HART Tri-Loop product manual.
Yes
DONE

Commissioning the Digital Valve Controller for use with the HART Tri-Loop Signal Converter

To prepare the digital valve controller for use with a 333 HART Tri-Loop, you must configure the digital valve controller to burst mode, and select Burst Command 3. In burst mode, the digital valve controller provides digital information to the HART Tri-Loop HART-to-Analog Signal Converter. The HART Tri-Loop converts the digital information to a 4 to 20 mA analog signal. Each burst message contains the latest value of the primary (analog input), secondary (travel target), tertiary (configured output pressure), and quaternary (travel) variables.

To commission a DVC6000 HW2 for use with a HART Tri-Loop, perform the following procedures.

Note

The DVC6000 HW2 must be in HART 5 compatibility mode to use burst communications.

Enable Burst Operation

Field Communicator	With I/O Package Configure > Manual Setup > Outputs > Burst Mode (2-2-6-5) HC, AD, PD or (2-2-7-5) ODV Without I/O Package Configure > Manual Setup > Outputs > Burst Mode (2-2-6-2) HC, AD, PD or (2-2-7-2) ODV

Select *Burst Enable* and follow the prompts to enable burst mode. Then select *Burst Command* and follow the prompts to configure *Loop Current/PV/SV/TV/QV*.

Select the HART Variable Assignments

Field Communicator	With I/O Package Configure > Manual Setup > Outputs > HART Variable Assignments (2-2-6-4) HC, AD, PD or (2-2-7-4) ODV Without I/O Package Configure > Manual Setup > Outputs > HART Variable Assignments (2-2-6-1) HC, AD, PD or (2-2-7-1) ODV

Configure the *HART Variable Assignments*. The Primary Variable (PV) is always Analog Input. The Secondary Variable (SV), Tertiary Variable (TV) and Quaternary Variable (QV) can be configured to any of the following variables.

- Setpoint
- Travel (see note below)
- Pressure A
- Pressure B
- Pressure A-B
- Supply Pressure
- Drive Signal
- Analog Input

Note

If the instrument is configured to operate in pressure control mode, or detects an invalid travel sensor reading, the Travel variable will report pressure in percent of bench set range.

Section 3 Configuration

Guided Setup

Field Communicator	Configure > Guided Setup (2-1)

The following procedures will guide you through the instrument setup process.

- Device Setup—This procedure is used to configure actuator and valve information, calibrate the valve assembly, and assign the tuning set for the valve assembly.
- Performance Tuner (instrument level AD, PD, ODV)—This procedure executes a simple step response test and then calculates a recommended set of gain values based on the response of the control valve. See page 30 for additional information.
- Stabilize Optimize (instrument level HC)—This procedure permits you to adjust valve response by changing the digital valve controller tuning. See page 30 for additional information.

Manual Setup

Manual Setup allows you to configure the digital valve controller to your application. Table 3-1 lists the default settings for a standard factory configuration. You can adjust actuator response, set the various modes, alerts, ranges, travel cutoffs and limits. You can also restart the instrument and set the protection.

Table 3-1. Default Detailed Setup Parameters

Setup Parameter		Default Setting[1]
Instrument Configuration	Control Mode	Analog
	Restart Control Mode	Resume Last
	Analog In Range Low	4 mA
	Analog In Range High	20 mA
	Analog Input Units	mA
	Local AutoCal Button	Disabled
	Polling Address	0
	Burst Mode Enable	No
	Burst Command	3
	Cmd 3 (Trending) Pressure	A-B
Dynamic Response and Tuning	Input Characterization	Linear
	Travel Limit High	125%
	Travel Limit Low	-25%
	Travel/Pressure Cutoff High	99.46%
	Travel/Pressure Cutoff Low	0.50%
	Set Point Rate Open	0%/sec
	Set Point Rate Close	0%/sec
	Set Point Filter Time (Lag Time)	0 sec
	Integrator Enable	Yes
	Integral Gain	9.4 repeats/minute
	Integral Deadzone	0.26%

-continued on next page-

Table 3-1. Default Detailed Setup Parameters (continued)

Setup Parameter		Default Setting(1)
Deviation & Other Alerts	Travel Deviation Alert Enable	Yes
	Travel Deviation Alert Point	5%
	Travel Deviation Time	9.99 sec
	Pressure Deviation Alert Enable	Yes
	Pressure Deviation Alert Point	5 psi(2)
	Pressure Deviation Alert Time	5.0 sec
	Drive Signal Alert Enable	Yes
	Supply Pressure Alert Enable	Yes

1. The settings listed are for standard factory configuration. DVC6000 HW2 instruments can also be ordered with custom configuration settings. Refer to the order requisition for custom settings (if specified) .
2. Adjust to bar, kPa, or Kg/cm^2 if necessary

Mode and Protection

Field Communicator	Configure > Manual Setup > Mode and Protection (2-2-1)

Instrument Mode

There are two instrument modes for the DVC6000 HW2; In Service or Out of Service. In Service is the normal operating mode such that the instrument follows the 4-20 mA control signal. Out of Service is required in some cases to modify configuration parameters or to run diagnostics.

Note

Some changes that require the instrument to be taken Out Of Service will not take effect until the instrument is placed back In Service or the instrument is restarted.

Write Protection

There are two Write Protection modes for the DVC6000 HW2: Not Protected or Protected. Protected prevents configuration and calibration changes to the instrument. The default setting is Not Protected. Write Protection can be changed to Protected remotely. However, to change Write Protection to Not Protected, you must have physical access to the instrument. The procedure will require you to press a button ( ) on the terminal box as a security measure.

Instrument

Field Communicator	Configure > Manual Setup > Instrument (2-2-2)

Follow the prompts on the Field Communicator display to configure the following Instrument parameters:

Identification

- HART Tag—A tag name up to 8 characters is available for the instrument. The HART tag is the easiest way to distinguish between instruments in a multi-instrument environment. Use the HART tag to label instruments electronically according to the requirements of your application. The tag you assign is automatically displayed when the Field Communicator establishes contact with the digital valve controller at power-up.
- HART Long Tag (HART Universal Revision 7 only)—A tag name up to 32 characters is available for the instrument.

- Description—Enter a description for the application with up to 16 characters. The description provides a longer user-defined electronic label to assist with more specific instrument identification than is available with the HART tag.
- Message—Enter any message with up to 32 characters. Message provides the most specific user-defined means for identifying individual instruments in multi-instrument environments.
- Polling Address—If the digital valve controller is used in point-to-point operation, the Polling Address is 0. When several devices are connected in the same loop, such as for split ranging, each device must be assigned a unique polling address. The Polling Address is set to a value between 0 and 63 for HART 7 and 0 and 15 for HART 5. To change the polling address the instrument must be Out Of Service.

  For the Field Communicator to be able to communicate with a device whose polling address is not 0, it must be configured to automatically search for all or specific connected devices.

Serial Numbers

- Instrument Serial Number—Enter the serial number on the instrument nameplate, up to 12 characters.
- Valve Serial Number—Enter the serial number for the valve in the application, up to 12 characters.

Units

- Pressure Units—Defines the output and supply pressure units in either psi, bar, kPa, or kg/cm^2.
- Temperature Units—Degrees Fahrenheit or Celsius. The temperature measured is from a sensor mounted on the digital valve controller's printed wiring board.
- Analog Input Units—Permits defining the Analog Input Units in mA or percent of 4-20 mA range.

Terminal Box

- Calibration (CAL) Button—This button is near the wiring terminals in the terminal box and provides a quick means to autocalibrate the instrument. The button must be pressed for 3 to 10 seconds. Autocalibration will move the valve through the full range of travel whether the Instrument Mode is In Service or Out of Service. However, if the Write Protection is Protected, this button will not be active. To abort, press the button again for 1 second. The calibration button is disabled by default.
- Auxiliary Terminal Action—These wire terminals can be configured to initiate a partial stroke test upon detection of a short across the (+) and (-) terminals. The terminals must be shorted for 3 to 10 seconds.

Note

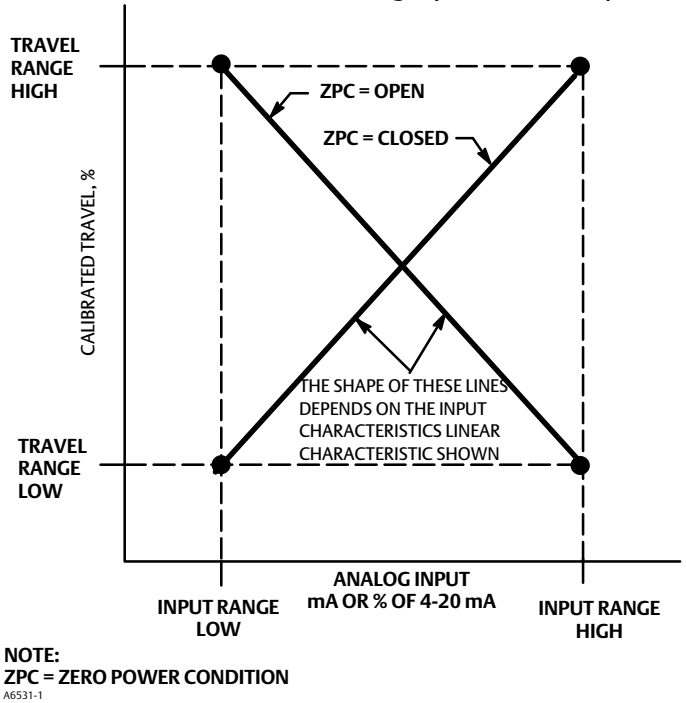
Auxiliary Terminal Action is only available for instrument level ODV.

Analog Input Range

- Input Range Hi—Permits setting the Input Range High value. Input Range High should correspond to Travel Range High, if the Zero Power Condition is configured as closed. If the Zero Power Condition is configured as open, Input Range High corresponds to Travel Range Low. See figure 3-1.

- Input Range Lo—Permits setting the Input Range Low value. Input Range Low should correspond to Travel Range Low, if the Zero Power Condition is configured as closed. If the Zero Power Condition is configured as open, Input Range Low corresponds to Travel Range High. See figure 3-1.

Figure 3-1. Calibrated Travel to Analog Input Relationship


TRAVEL RANGE HIGH
ZPC = OPEN
ZPC = CLOSED
CALIBRATED TRAVEL, %
THE SHAPE OF THESE LINES DEPENDS ON THE INPUT CHARACTERISTICS LINEAR CHARACTERISTIC SHOWN
TRAVEL RANGE LOW
ANALOG INPUT mA OR % OF 4-20 mA
INPUT RANGE LOW
INPUT RANGE HIGH
NOTE:
ZPC = ZERO POWER CONDITION
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Spec Sheet

The Spec Sheet provides a means to store the entire control valve specifications on board the DVC6000 HW2.

Edit Instrument Time

Permits setting the instrument clock. When alerts are stored in the alert record, the record includes the time and date. The instrument clock uses a 24-hour format.

Travel/Pressure Control

Field Communicator	Configure > Manual Setup > Travel/Pressure Control (2-2-3)

Travel/Pressure Select

This defines the operating mode of the instrument as well as the behavior of the instrument should the travel sensor fail. There are four choices:

- Travel Control—The instrument is controlling to a target travel. Fallback is not enabled.
- Pressure Control—The instrument is controlling to a target pressure. Fallback is not enabled.
- Fallback-Sensor Failure—The instrument will fallback to pressure control if a travel sensor failure is detected.

- Fallback-Sensor/Tvl Deviation—The instrument will fallback to pressure control if a travel sensor failure is detected, or if the Tvl Dev Press Fallback setting is exceeded for more than the Tvl Dev Press Fallback Time.

Note

Travel / Pressure Select must be set to Travel for double-acting actuators

Cutoffs and Limits

- Hi Limit/Cutoff Select—When the Hi Cutoff/Limit Select is configured for Cutoff, the Travel Target is set to 123% when the Travel exceeds the Hi Cutoff Point. When the Hi Cutoff/Limit Select is configured for Limit, the Travel Target will not exceed the Hi Limit Point.

- Hi Limit/Cutoff Point—This is the point within the calibrated travel range above which the Limit or Cutoff is in effect. When using cutoffs, a Cutoff Hi of 99.5% is recommended to ensure valve goes fully open. The Hi Cutoff/Limit is deactivated by setting it to 125%.

- Lo Limit/Cutoff Select—When the Lo Cutoff/Limit Select is configured for Cutoff, the Travel Target is set to -23% when the Travel is below the Lo Cutoff Point. When the Hi Cutoff/Limit Select is configured for Limit, the Travel Target will not fall below the Lo Limit Point.

- Lo Limit/Cutoff Point—This is the point within the calibrated travel range below which the Limit or Cutoff is in effect. When using cutoffs, a Cutoff Lo of 0.5% is recommended to help ensure maximum shutoff seat loading. The Lo Limit/Cutoff is deactivated by setting it to -25%.

End Point Pressure Control (EPPC)

Note

End Point Pressure Control is available for instrument level ODV.

- EPPC Enable—Select Yes or No. End Point Pressure Control allows the digital valve controller to pull back from saturation of the pneumatic output after reaching the travel extreme. Rather than having the instrument provide full supply pressure (saturation) continuously at the travel extreme, the digital valve controller switches to an End Point Pressure Control where the output pressure (pressure controller set point) to the actuator is maintained at a certain value. This value is configured through the Upper Operating Pressure feature. Because the digital valve controller is constantly in control and not allowed to reach a dormant or saturated state, it is constantly testing its own pneumatic system. If there is an output pressure deviation, for example, the instrument will issue an alert. To ensure there is an alert when an output pressure deviation occurs, setup the alert as described under Pressure Deviation Alert.

- EPPC Set Point—Used in conjunction with End Point Pressure Control, End Point Pressure Control Set Point allows you to select a pressure to be delivered by the instrument at the travel extreme. For a fail-closed valve, this pressure must be sufficient to maintain the fully open position. For a fail-open valve, this pressure (which is automatically set to supply pressure) must be sufficient to fully close the valve and maintain its rated shutoff classification. For double-acting spring return actuators, this is the differential pressure required to either maintain the fully open or fully closed position, depending on the valve and actuator configuration. For a double-acting actuator without springs with a fail-close valve, this is 95% of the supply pressure. If the valve is fail-open, the upper operating pressure for all actuators is set to the supply pressure.

- EPPC Saturation Time—End Point Pressure Control Saturation Time is the time the digital valve controller stays in hard cutoff before switching to pressure control. Default is 45 seconds.

Pressure Control

- Pressure Range High—The high end of output pressure range. Enter the pressure that corresponds with 100% valve travel when Zero Power Condition is closed, or 0% valve travel when Zero Power Condition is open. This pressure *must be greater* than the Pressure Range Lo.

- Pressure Range Lo—The low end of the output pressure range. Enter the pressure that corresponds to 0% valve travel when Zero Power Condition is closed, or 100% valve travel when Zero Power Condition is open. This pressure *must be less* than the Pressure Range Hi.

Pressure Fallback

Note

Pressure Fallback is available for instrument level AD, PD, ODV.

- Tvl Dev Press Fallback—When the difference between the travel target and the actual travel exceeds this value for more than the Tvl Dev Press Fallback Time, the instrument will disregard the travel feedback and control based on output pressure.

- Tvl Dev Press Fallback Time—The time, in seconds, that the travel target and the actual travel must be exceeded before the instrument falls back into pressure control.

- Fallback Recovery—If the instrument has fallen into pressure control and the feedback problem is resolved, recovery to travel control can occur automatically or with manual intervention. To return to travel control when Manual Recovery is selected, change the Fallback Recovery to Auto Recovery, and then back to Manual Recovery (if desired).

Control Mode

- Control Mode—Displays the current control mode of the instrument. This will show Analog if the instrument is in Point-to-Point mode and is using a 4-20 mA signal for its power and set point. This will show Digital if the instrument is in Multidrop mode and is using 24 VDC for power and a digital set point for control.

Note

Another mode, Test, may be displayed. Normally the instrument should not be in the Test mode. The digital valve controller automatically switches to this mode whenever it needs to stroke the valve during calibration or stroke valve, for example. However, if you abort from a procedure where the instrument is in the test mode, it may remain in this mode. To take the instrument out of the Test mode, select *Change Control Mode* and enter Analog or Digital.

- Change Control Mode—Allows you to configure the control mode to Analog or Digital.

- Restart Control Mode—Defines the Control Mode of the instrument after a restart (e.g. power cycle). Available choices are Resume Last, Analog and Digital.

Characterization

- Input Characterization

Input Characterization defines the relationship between the travel target and ranged set point. Ranged set point is the input to the characterization function. If the zero power condition equals closed, then a set point of 0% corresponds to a ranged input of 0%. If the zero power condition equals open, a set point of 0% corresponds to a ranged input of 100%. Travel target is the output from the characterization function.

To select an input characterization, select *Input Characterization* from the *Characterization* menu. You can select from the three fixed input characteristics shown in figure 3-2 or you can select a custom characteristic. Figure 3-2 shows the relationship between the travel target and ranged set point for the fixed input characteristics, assuming the Zero Power Condition is configured as closed.

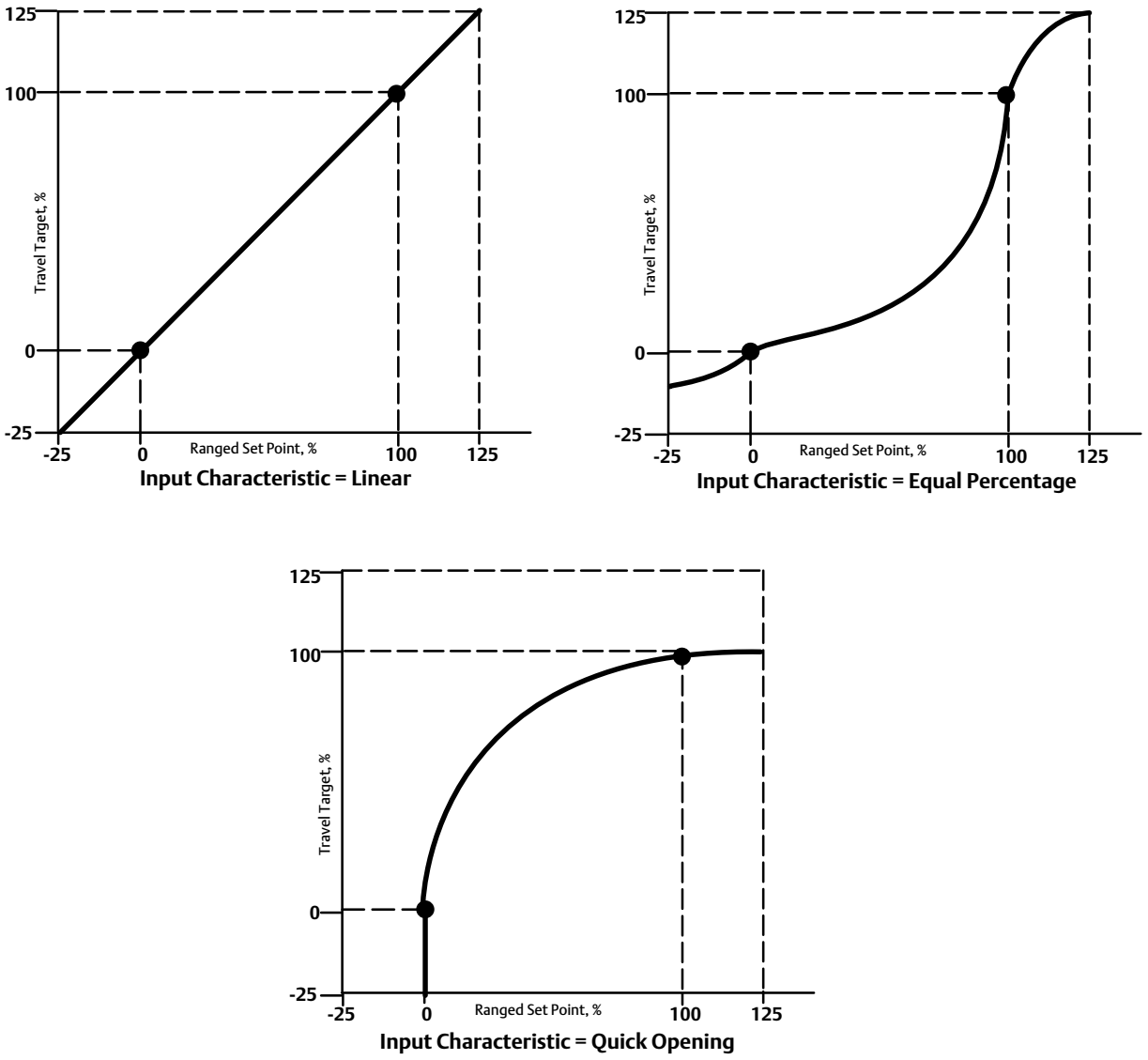
You can specify 21 points on a custom characteristic curve. Each point defines a travel target, in % of ranged travel, for a corresponding set point, in % of ranged set point. Set point values range from -6.25% to 106.25%. Before modification, the custom characteristic is linear.

- Custom Characterization

To define a custom input character, select *Custom Characterization* from the *Characterization* menu. Select the point you wish to define (1 to 21), then enter the desired set point value. Press Enter then enter the desired travel target for the corresponding set point. When finished, select point 0 to return to the *Characterization* menu.

With input characterization you can modify the overall characteristic of the valve and instrument combination. Selecting an equal percentage, quick opening, or custom (other than the default of linear) input characteristic modifies the overall valve and instrument characteristic. However, if you select the linear input characteristic, the overall valve and instrument characteristic is the characteristic of the valve, which is determined by the valve trim (i.e., the plug or cage).

Figure 3-2. Travel Target Versus Ranged Set Point, for Various Input Characteristics (Zero Power Condition = Closed)



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Dynamic Response

- SP Rate Open—Maximum rate (% of valve travel per second) at which the digital valve controller will move to the open position regardless of the rate of input current change. A value of 0 will deactivate this feature and allow the valve to stroke open as fast as possible.

- SP Rate Close—Maximum rate (% of valve travel per second) at which the digital valve controller will move to the close position regardless of the rate of input current change. A value of 0 will deactivate this feature and allow the valve to stroke close as fast as possible.

- Set Point Filter Time (Lag Time)—The Set Point Filter Time (Lag Time) slows the response of the digital valve controller. A value ranging from 0.2 to 10.0 can be used for noisy or fast processes to improve closed loop process control. Entering a value of 0.0 will deactivate the lag filter.

Note

Set Point Filter Time (Lag Time) is available for instrument level HC, AD, and PD.

- Lead/Lag Set Point Filter—ODV devices have access to a lead-lag set point filter that can be used to improve a valve's dynamic response. The lead-lag filter is part of the set point processing routine that reshapes the input signal before it becomes travel set point. Lead-lag filters are characterized by lead and lag time constants.

Note

Lead/Lag is only available for instrument level ODV.

When the valve is in its active control region (off the seat), the lead-lag filter improves small amplitude response by momentarily overdriving the travel set point. This is useful when the actuator is large and equipped with accessories. As a result, any volume boosters that are present will be activated. The longer the lag time, the more pronounced the overdrive. Since the lead-lag input filter is used to enhance the dynamic response of a control valve, filter parameters should be set after the tuning parameters have been established.

When the valve is at its seat, the lead-lag filter also has a boost function that sets the initial conditions of the filter artificially low so that small amplitude signal changes appear to be large signal changes to the filter. The boost function introduces a large spike that momentarily overdrives the instrument and activates any external volume boosters that may be present. The lead-lag boost function is normally disabled except for those cases where the valve must respond to small command signals off the seat. By setting the lead/lag ratio in the opening and closing directions to 1.0, the boost function can be enabled without introducing lead-lag dynamics in the active control region. See table 3-2 for typical lead-lag filter settings.

Table 3-2. Typical Lead/Lag Filter Settings for Instrument Level ODV

Parameter	Description	Typical Value
Lag Time	First order time constant. A value of 0.0 will disable the lead-lag filter.	0.2 sec
Opening Lead/Lag Ratio	Initial response to the filter in the opening direction.	2.0
Closing Lead/Lag Ratio	Initial response to the filter in the closing direction.	2.0
Lead-Lag Boost	Initial conditions of the lead-lag filter when the lower travel cutoff is active.	Off

Tuning

Field Communicator	Configure > Manual Setup > Tuning (2-2-4)

Travel Tuning

⚠ WARNING

Changes to the tuning set may cause the valve/actuator assembly to stroke. To avoid personal injury and property damage caused by moving parts, keep hands, tools, and other objects away from the valve/actuator assembly.

- Travel Tuning Set

There are eleven tuning sets to choose from. Each tuning set provides a preselected value for the digital valve controller gain settings. Tuning set C provides the slowest response and M provides the fastest response.

Table 3-3 lists the proportional gain, velocity gain and minor loop feedback gain values for preselected tuning sets.

Table 3-3. Gain Values for Preselected Travel Tuning Sets

Tuning Set	Proportional Gain	Velocity Gain	Minor Loop Feedback Gain
C	4.4	3.0	35
D	4.8	3.0	35
E	5.5	3.0	35
F	6.2	3.1	35
G	7.2	3.6	34
H	8.4	4.2	31
I	9.7	4.85	27
J	11.3	5.65	23
K	13.1	6.0	18
L	15.5	6.0	12
M	18.0	6.0	12
X (Expert)	User Adjusted	User Adjusted	User Adjusted

In addition, you can specify Expert tuning and individually set the proportional gain, velocity gain, and minor loop feedback gain. Individually setting or changing any tuning parameter or running the Performance Tuner or Stabilize Optimize routine will automatically change the tuning set to X (expert).

Note

Use Expert tuning only if standard tuning has not achieved the desired results.

Stabilize/Optimize or Performance Tuner may be used to achieve the desired results more rapidly than manual Expert tuning.

Table 3-4 provides tuning set selection guidelines for Fisher and Baumann actuators. These tuning sets are only recommended starting points. After you finish setting up and calibrating the instrument, you may have to select either a higher or lower tuning set to get the desired response. You can use the Performance Tuner to optimize tuning.

Table 3-4. Actuator Information for Initial Setup

Actuator Manufacturer	Actuator Model	Actuator Size	Actuator Style	Starting Tuning Set	Feedback Connection	Travel Sensor Motion Relay A or C(1)	
Fisher	585C & 585CR	25 50 60 68, 80 100, 130	Piston Dbl with or w/out Spring. See actuator instruction manual and nameplate.	E I J L M	SStem-Standard for travels up to 4 inches. SStem-Roller for longer travels	Depends upon pneumatic connections. See description for Travel Sensor Motion	
	657	30 34, 40 45, 50 46, 60, 70, 76, & 80-100	Spring & Diaphragm	H K L M	SStem-Standard	Clockwise	
	667	30 34, 40 45, 50 46, 60, 70, 76, & 80-100	Spring & Diaphragm	H K L M	SStem-Standard	Counterclockwise	
	1051 & 1052	20, 30 33 40 60, 70	Spring & Diaphragm	H I K M	Rotary	Clockwise	
	1061	30 40 60 68, 80, 100, 130	Piston Dbl w/o Spring	J K L M	Rotary	Depends upon pneumatic connections. See description for Travel Sensor Motion	
	1066SR	20 27, 75	Piston Sgl w/Spring	G L	Rotary	Mounting Style	Travel Sensor Motion
						A	Clockwise
						B	Counterclockwise
						C	Clockwise
						D	Counterclockwise
	2052	1 2 3	Spring & Diaphragm	H J M	Rotary	Clockwise	
	3024C	30, 30E 34, 34E, 40, 40E 45, 45E	Spring & Diaphragm	E H K	SStem-Standard	For P_o operating mode (air opens): Counterclockwise For P_s operating mode (air closes): Clockwise	
	GX	225	Spring & Diaphragm	X(1)	SStem-Standard	Air to Open	Air to Close
		750		K		Counterclockwise	Clockwise
		1200		M			
Baumann	Air to Extend	16 32 54	Spring & Diaphragm	C E H	SStem-Standard	Clockwise	
	Air to Retract					Counterclockwise	
	Rotary	10 25 54		E H J	Rotary	Specify	

1. X = Expert Tuning. Proportional Gain = 4.2; Velocity Gain = 3.0; Minor Loop Feedback Gain = 18.0
2. Values shown are for Relay A and C. Reverse for Relay B.

- Proportional Gain—The proportional gain for the travel control tuning set. Changing this parameter will also change the tuning set to Expert.
- Velocity Gain—The velocity gain for the travel control tuning set. Changing this parameter will also change the tuning set to Expert.
- MLFB Gain—The minor loop feedback gain for the travel control tuning set. Changing this parameter will also change the tuning set to Expert.

- Integral Enable—Yes or No. Enable the integral setting to improve static performance by correcting for error that exists between the travel target and actual travel. Travel Integral Control is enabled by default.
- Integral Gain—Travel Integral Gain is the ratio of the change in output to the change in input, based on the control action in which the output is proportional to the time integral of the input.
- Performance Tuner

⚠ WARNING

During performance tuning the valve may move, causing process fluid or pressure to be released. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

Note

The Performance Tuner is available for instrument level AD, PD, and ODV and can only be run while in Travel control mode.

The Performance Tuner is used to determine digital valve controller tuning. It can be used with digital valve controllers mounted on most sliding-stem and rotary actuators, including Fisher and other manufacturers' products. Moreover, because the performance tuner can detect internal instabilities before they become apparent in the travel response, it can generally optimize tuning more effectively than manual tuning. Typically, the performance tuner takes 3 to 5 minutes to tune an instrument, although tuning instruments mounted on larger actuators may take longer.

- Stabilize/Optimize

⚠ WARNING

During Stabilize/Optimize the valve may move, causing process fluid or pressure to be released. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

Stabilize/Optimize permits you to adjust valve response by changing the digital valve controller tuning. During this routine the instrument must be out of service, however, the instrument will respond to setpoint changes.

If the valve is unstable, select *Decrease Response* to stabilize valve operation. This selects the next lower tuning set (e.g., F to E). If the valve response is sluggish, select *Increase Response* to make the valve more responsive. This selects the next higher tuning set (e.g., F to G).

If after selecting *Decrease Response* or *Increase Response* the valve travel overshoot is excessive, select *Decrease Damping* to select a damping value that allows more overshoot. Select *Increase Damping* to select a damping value that will decrease the overshoot. When finished, select *done.*

Pressure Tuning

- Pressure Tuning Set

There are twelve Pressure Tuning Sets to choose from. Each tuning set provides a preselected value for the digital valve controller gain settings. Tuning set C provides the slowest response and M provides the fastest response. Tuning set B is appropriate for controlling a pneumatic positioner. Table 3-5 lists the proportional gain, pressure integrator gain and minor loop feedback gain values for preselected tuning sets.

Table 3-5. Gain Values for Preselected Pressure Tuning Sets

Tuning Set	Proportional Gain	Integrator Gain	Minor Loop Feedback Gain
B	0.5	0.3	35
C	2.2	0.1	35
D	2.4	0.1	35
E	2.8	0.1	35
F	3.1	0.1	35
G	3.6	0.1	34
H	4.2	0.1	31
I	4.8	0.1	27
J	5.6	0.1	23
K	6.6	0.1	18
L	7.8	0.1	12
M	9.0	0.1	12
X (Expert)	User Adjusted	User Adjusted	User Adjusted

In addition, you can specify Expert tuning and individually set the pressure proportional gain, pressure integrator gain, and pressure minor loop feedback gain. Individually setting or changing any tuning parameter will automatically change the tuning set to X (expert).

Note

Use Expert tuning only if standard tuning has not achieved the desired results.

Stabilize/Optimize or Performance Tuner may be used to achieve the desired results more rapidly than Expert tuning.

- Proportional Gain—The proportional gain for the pressure control tuning set. Changing this parameter will also change the tuning set to Expert.
- MLFB Gain—The minor loop feedback gain for the pressure control tuning set. Changing this parameter will also change the tuning set to Expert.
- Integral Enable—Yes or No. Enable the pressure integral setting to improve static performance by correcting for error that exists between the pressure target and actual pressure. Pressure Integral Control is disabled by default.
- Integral Gain—Pressure Integral Gain (also called reset) is the gain factor applied to the time integral of the error signal between desired and actual pressure. Changing this parameter will also change the tuning set to Expert.

Travel/Pressure Integral Settings

- Integral Dead Zone—A window around the Primary Setpoint in which integral action is disabled. This feature is used to eliminate friction induced limit cycles around the Primary Setpoint when the integrator is active. The Dead Zone is configurable from 0% to 2%, corresponding to a symmetric window from 0% to +/-2% around the Primary Setpoint. Default value is 0.25%.

- Integrator Limit—The Integrator Limit provides an upper limit to the integrator output. The high limit is configurable from 0 to 100% of the I/P drive signal.

Valve and Actuator

Field Communicator	Configure > Manual Setup > Valve and Actuator (2-2-5)

Valve Style—Enter the valve style, rotary or sliding-stem

Actuator Style—Enter the actuator style, spring and diaphragm, piston double-acting without spring, piston single-acting with spring, or piston double-acting with spring.

View/Edit Feedback Connection—Select Rotary All, SStem - Roller or SStem - Standard. For rotary valves, enter Rotary - All, SStem - Roller. For sliding-stem valves, if the feedback linkage consists of a connector arm, adjustment arm, and feedback arm (similar to figure 3-3), enter SStem - Standard. If the feedback linkage consists of a roller that follows a cam (similar to figure 3-4), enter Rotary All, SStem - Roller.

Figure 3-3. Feedback Connection for Typical Sliding-Stem Actuator (Up to 4 inch Travel)

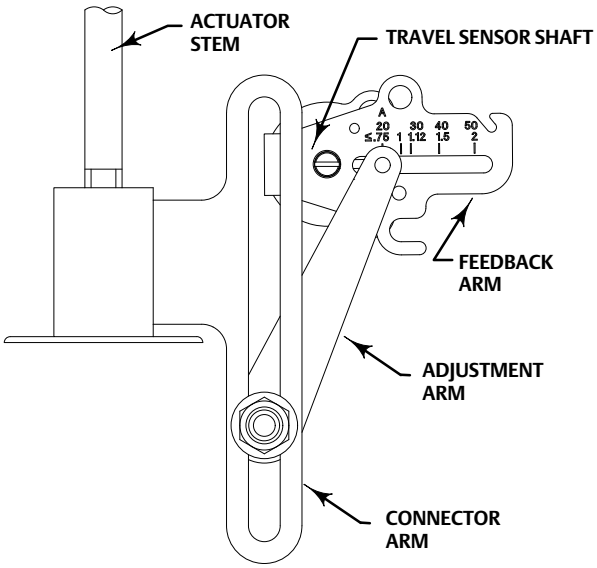
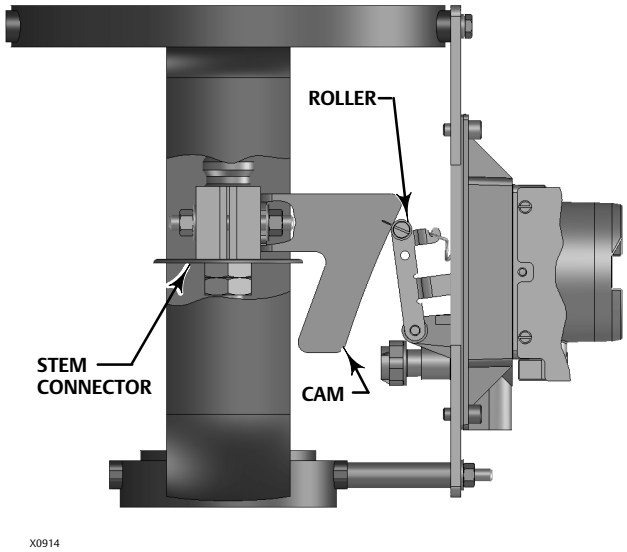


Figure 3-4. Feedback Connection for Typical Long-Stroke Sliding-Stem Actuator (4 to 24 Inches Travel)



Relay Type—There are three categories of relays that result in combinations from which to select.

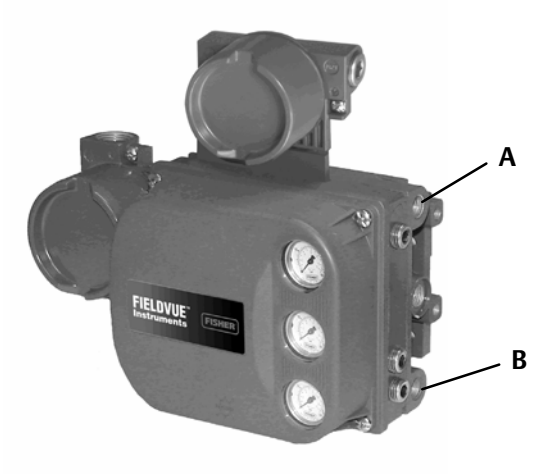
Relay Type: The relay type is printed on the label affixed to the relay body.
- A = double-acting or single-acting
- B = single-acting, reverse
- C= single-acting, direct

Special App: This is used in single-acting applications where the “unused” output port is configured to read the pressure downstream of a solenoid valve.

Lo Bleed: The label affixed to the relay body indicates whether it is a low bleed version.

Zero Power Condition—The position of the valve (open or closed) when the electrical power to the instrument is removed. Zero Power Condition (ZPC) is determined by relay type, as shown in figure 3-5.

Figure 3-5. Zero Power Condition



Relay Type	Loss of Electrical Power
Single-Acting Direct (Relay A or C)	Port A pressure to zero.
Double-Acting (Relay A)	Port A pressure to zero. Port B pressure to full supply.
Single-Acting Reverse (Relay B)	Port B pressure to full supply.

Travel Sensor Motion

⚠ WARNING

If you answer YES to the prompt for permission to move the valve when determining travel sensor motion, the instrument will move the valve through a significant portion of its travel range. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

Travel Sensor Motion—Select Clockwise, or Counterclockwise. Travel Sensor Motion establishes the proper travel sensor rotation. Determine the rotation by viewing the end of the travel sensor shaft from the perspective of the actuator.

- For instruments with Relay A and C: If increasing air pressure at output A causes the shaft to turn clockwise, enter Clockwise. If it causes the shaft to turn counterclockwise, enter Counterclockwise.
- For instruments with Relay B: If increasing air pressure at output B causes the shaft to turn counterclockwise, enter Clockwise. If it causes the shaft to turn clockwise, enter Counterclockwise.

Maximum Supply Pressure

Enter the maximum supply pressure that is required to fully stroke the valve.

Partial Stroke Test (PST) (Instrument Level ODV only)

Field Communicator	Configure > Manual Setup > Partial Stroke (2-2-6)

Note

Partial Stroke is only available for instrument level ODV.

Partial Stroke Test (PST)

- PST Pressure Limit— This defines the actuator pressure at which a partial stroke test will abort. This prevents the DVC6000 HW2 from exhausting (or building) excessive pressure to the actuator in an attempt to move a stuck valve. During Device Setup or Auto Travel Calibration, the Partial Stroke Pressure Limit will be set automatically as follows:

  Single Acting Actuators - For those actuators that exhaust pressure from the partial test start point, the Pressure Limit will be a minimum value. For those actuators that build pressure from the partial test start point, the Pressure Limit will be a maximum value.

  Double Acting Actuators - The Pressure Limit will be set to a negative value for actuators where the partial stroke start point is opposite of the Zero Power Condition (e.g., Partial Stroke Start Point = *Open* and Zero Power Condition = *Closed*) and to a positive valve for actuators where the partial stroke start point is the same as the Zero Power Condition.

  The pressure signal used to determine this parameter depends on relay type and is summarized below.

Relay Type	Pressure Signal
A or C	Port A - Port B
B	Port B - Port A
B Special App.	Port B
C Special App.	Port A

To manually set the partial stroke pressure limit, you must examine current partial stroke test results using ValveLink software. The following steps will guide you through the process:

1. Connect the DVC6000 HW2 to a system running ValveLink software.
2. Disable the following parameters:
   - Travel Deviation Alert - set to 125%.
   - End Point Pressure Control - disable
   - Partial Stroke Pressure Limit - disable by setting the appropriate value shown in table 3-6.

Table 3-6. Values for Disabling Partial Stroke Pressure Limit

Actuator Type	Relay Type	Zero Power Condition	Partial Stroke Start Point	Partial Stroke Pressure Limit (Disabled)
Single Acting	A or C	Closed	Open	0.0
			Closed	Psupply
		Open	Open	Psupply
			Closed	0.0
	B	Closed	Open	Psupply
			Closed	0.0
		Open	Open	0.0
			Closed	Psupply
Double Acting	A	Closed	Open	-Psupply
			Closed	Psupply
		Open	Open	Psupply
			Closed	-Psupply

3. Run a partial stroke test.
4. Select the Press/Time radio button on the partial stroke graph (refer to the example in figure 3-6, bottom plot). If the actuator pressure starts high and moves low, find the minimum actuator pressure (Pmin). If the actuator pressure starts low and moves high, find the maximum actuator pressure (Pmax). Double-acting actuators will display differential pressure. Use table 3-7 to estimate the partial stroke pressure limit.

Table 3-7. Estimates for Partial Stroke Pressure Limits

Actuator Style	Relay Type	Zero Power Condition	PST Starting Point	Partial Stroke Pressure Limit(1)
Spring and Diaphragm	A or C	Closed	Open	Pmin - 0.25 * (Bench Set High - Bench Set Low)
			Closed	Pmax + 0.25 * (Bench Set High - Bench Set Low)
		Open	Open	Pmax + 0.25 * (Bench Set High - Bench Set Low)
			Closed	Pmin - 0.25 * (Bench Set High - Bench Set Low)
	B	Closed	Open	Pmax + 0.25 * (Bench Set High - Bench Set Low)
			Closed	Pmin - 0.25 * (Bench Set High - Bench Set Low)
		Open	Open	Pmin - 0.25 * (Bench Set High - Bench Set Low)
			Closed	Pmax + 0.25 * (Bench Set High - Bench Set Low)
Single Acting Piston	A or C	Closed	Open	0.5 * Pmin
			Closed	Pmax + 0.5 * (Psupply - Pmax)
		Open	Open	Pmax + 0.5 * (Psupply - Pmax)
			Closed	0.5 * Pmin
	B	Closed	Open	Pmax + 0.5 * (Psupply - Pmax)
			Closed	0.5 * Pmin
		Open	Open	0.5 * Pmin
			Closed	Pmax + 0.5 * (Psupply - Pmax)
Double Acting Piston	A	Closed	Open	Pmin - 0.5 * (Psupply + Pmin)
			Closed	Pmax + 0.5 * (Psupply - Pmax)
		Open	Open	Pmax + 0.5 * (Psupply - Pmax)
			Closed	Pmin - 0.5 * (Psupply + Pmin)

5. Enable the parameters that were previously disabled:
   - Travel Deviation Alert - set to 1.5 x the maximum travel deviation between travel set point and travel.
   - End Point Pressure Control - enable
   - Partial Stroke Pressure Limit - calculate the value using table 3-7.

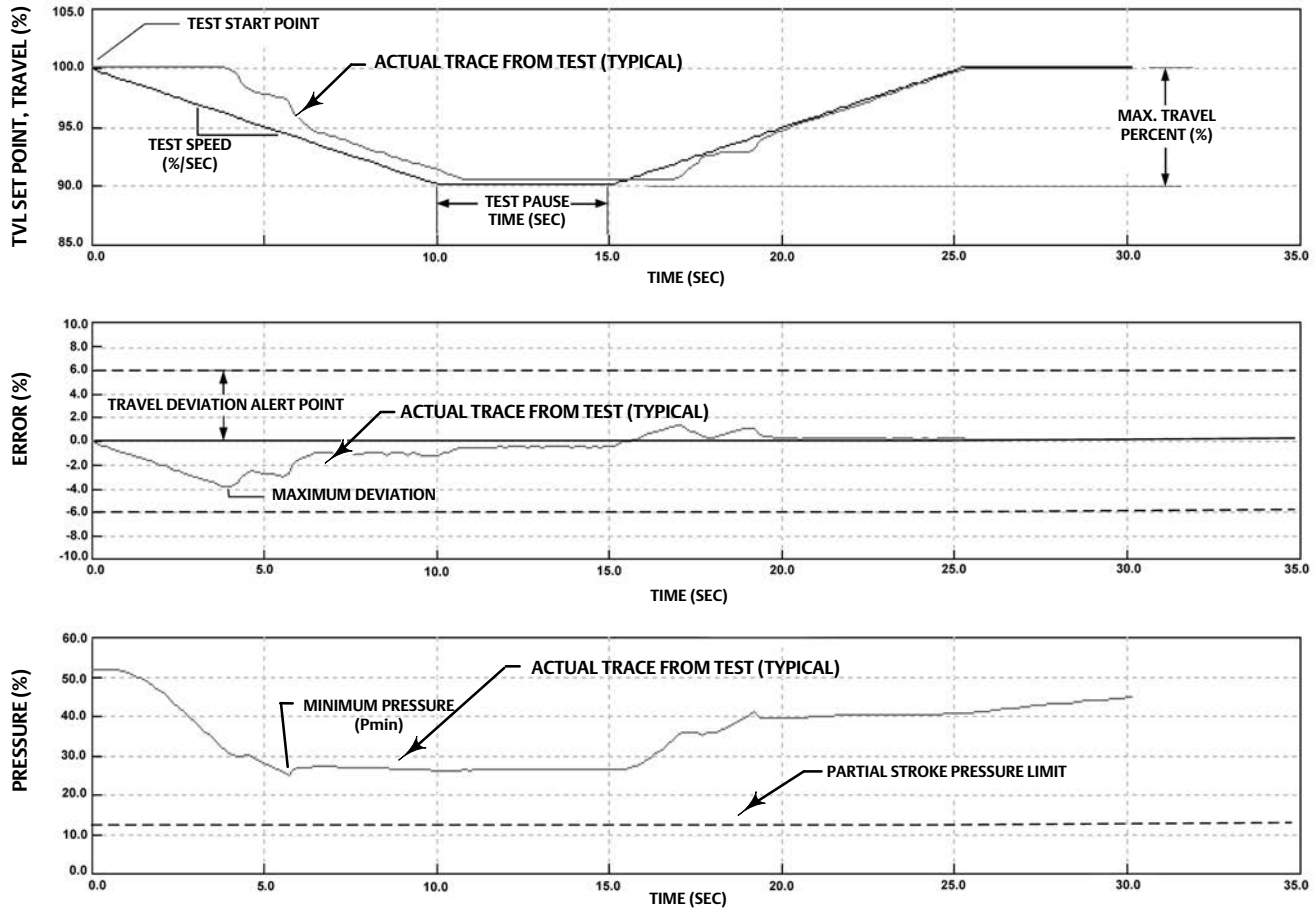
PST Enable—Yes or No. This enables or disables the Partial Stroke Test.

PST Start Point—Valve Open or Valve Closed. This defines the travel stop that the valve needs to be at before a partial stroke test can be initiated. This also defines the travel stop for end point pressure control. Setting this value to Not Configured will disable partial stroke tests and end point pressure control.

PST Variables—Follow the prompts on the Field Communicator display to enter or view information for following PST Variables:

- Max Travel Movement— The percentage of total span that the valve moves away from its normal operating state towards its tripped state during the test. The default value is 10%.
- Test Speed—The rate at which the valve will move during the test. The default value is 0.25%/second.
- Pause Time—The pause time between the up and down strokes of the test. The default value is 5 seconds.

Figure 3-6. Example Time Series Plots of Travel Set Point, Travel, Error, and Actuator Pressure



Outputs

Field Communicator	Configure > Manual Setup > Outputs (2-2-6) HC, AD, PD or (2-2-7) ODV

Note

These menu items are only available on units that have the optional 4-20 mA position transmitter or switch hardware installed.

Output Terminal Configuration

- Output Terminal Enable—If using the optional output terminal for a Position Transmitter or Switch output, this must be Enabled.
- Function—The output terminals can be configured as one of the following:

  Transmitter - 4-20 mA output that represents 0-100% of the calibrated valve travel.

  Limit Switch - Discrete switch (1 A max) that trips at a configurable point within 0-100% of calibrated valve travel.

  Alert Switch - Discrete switch (1 A max) that trips based on a configurable device alert.
- Fail Signal—Should the output circuit fail to operate properly, the output will attempt to drive to a known state. Depending on the nature of the failure, the circuit may or may not be able to achieve this fail state. When configured as a transmitter, the output can be configured to drive high (22.5 mA) or low (3.6 mA). When configured as a switch, the output can be configured to drive Closed or Open.

Note

On loss of positioner power, the switch circuit will always go to the open state. However, on loss of positioner power, the transmitter output will continue to operate as long as the transmitter circuit is still powered and functioning.

Switch Configuration

- Limit Switch Trip Point—When the function is configured as a Limit Switch, the Limit Switch Trip Point defines the threshold for the limit switch in percent of calibrated travel.
- Alert Switch Source—When the function is configured as an Alert Switch, the Alert Switch Source determines which alert will activate the switch. The alert choices are: Travel Deviation or Pressure Fallback.
- Switch Closed—Configures the action of the switch. The choices are: Below Trip Point / Alert Not Active or Above Trip Point / Alert Active.

HART Variable Assignments

Instrument variables can be reported via four different HART variable assignments. The Primary Variable is always configured as Analog Input. However, the remaining three variables have additional options as listed below.

Primary Variable (PV)	Analog Input
Secondary Variable (SV)	Travel, Travel Setpoint, Pressure A, Pressure B, Pressure A-B, Supply Pressure, Drive Signal, or Analog Input; default value is Travel Setpoint
Tertiary Variable (TV)	Travel, Travel Setpoint, Pressure A, Pressure B, Pressure A-B, Supply Pressure, Drive Signal, or Analog Input; default value is Pressure A.
Quaternary Variable (QV)	Travel, Travel Setpoint, Pressure A, Pressure B, Pressure A-B, Supply Pressure, Drive Signal, or Analog Input; default value is Travel.

Transmitter Output

This configures the relationship between the valve travel and the position transmitter output signal. There are two choices; 4mA = Valve Closed or 4mA = Valve Open.

Burst Mode

Burst mode provides continuous communication from the digital valve controller. Burst mode applies only to the transmission of burst mode data (HART Variable Assignments) and does not affect the way other data is accessed. Burst mode is only available in devices configured as HART Universal Revision 5.

- Burst Enable—Turns on or off the burst mode.
- Burst Command—Defines which HART command is configured for burst reporting. There are three options to choose from. When using a Tri-Loop, select the third option.
  - Analog Input (Command 1)
  - Loop Current / Travel (Command 2)
  - Loop Current / PV / SV / TV / QV (Command 3)

Note

Access to information in the instrument is normally obtained through the poll/response of HART communication. The Field Communicator or the control system may request any of the information that is normally available, even while the instrument is in burst mode. Between each burst mode transmission sent by the instrument, a short pause allows the Field Communicator or control system to initiate a request. The instrument receives the request, processes the response message, and then continues "bursting" the burst mode data.

Burst mode will be disabled by ValveLink software during diagnostics tests such as Valve Signature.

Note

If the instrument is configured to operate in pressure control mode, or detects an invalid travel sensor reading, the Travel variable will report pressure in percent of bench set range.

Alert Setup

Field Communicator	Configure > Alert Setup (2-3)

An alert is a notification that the instrument has detected a problem. A shutdown is an action that the instrument takes to drive the air output to the Zero Power Condition as per figure 3-5. Some alerts can be configured to shutdown the instrument. Refer to table 3-8 for default alert and shutdown settings.

Alerts may be enabled or disabled with the instrument In Service, Out of Service, Protected, or Not Protected. However, the instrument must be Not Protected to enable or disable a shutdown. Alerts are not processed when a diagnostic is in progress.

If shutdown is enabled, and the alert is active, the instrument will latch in the shutdown state until power to the instrument is cycled and the alert has cleared. While in the shutdown condition, HART communication will continue if the instrument remains powered.

For a detailed explanation of the alerts and the recommended actions, refer to Section 5.

Table 3-8. Default Alert and Shutdown Settings

ALERT	DEFAULT ALERT SETTING	DEFAULT SHUTDOWN SETTING
Travel Sensor Failure	Enabled	Disabled
Temperature Sensor Failure	Enabled	Disabled
Minor Loop Sensor Failure	Enabled	Disabled
Pressure Sensor Failure	Enabled	Disabled
Drive Current Failure	Enabled	Disabled
Critical NVM Failure	Enabled	Disabled
Non-Critical NVM Failure	Enabled	Disabled
Flash Integrity Failure	Enabled	Disabled
Reference Voltage Failure	Enabled	Disabled
Drive Signal Out of Range	Enabled	Not Available
Supply Pressure Low(1)	Enabled	Not Available
Travel Deviation	Enabled	Not Available
Pressure Fallback Active(1)	Enabled	Not Available
High Travel	Disabled	Not Available
Low Travel	Disabled	Not Available
High-High Travel	Disabled	Not Available
Low-Low Travel	Disabled	Not Available
Travel Limit/Cutoff High	Disabled	Not Available
Travel Limit/Cutoff Low	Disabled	Not Available
Integrator Saturated High	Disabled	Not Available
Integrator Saturated Low	Disabled	Not Available
Cycle Count High	Disabled	Not Available
Travel Accumulator High	Disabled	Not Available
Output Circuit Communication Failure	Disabled	Not Available
Alert Record Not Empty	Disabled	Not Available
Alert Record Full	Disabled	Not Available
Instrument Time is Approximate	Disabled	Not Available

1. Instrument level AD, PD, or ODV only.

Change to HART 5 / Change to HART 7

Field Communicator	Service Tool > Maintenance > Change to HART 5 / Change to HART 7 (3-5-3) HC or (3-5-4) AD, PD or (3-5-5) ODV

Note

This procedure must never be done while the valve is in service and controlling the process. Depending on the control system or asset management system attached, complete system reset may be required to reestablish HART communication. Consult the system documentation for further information.

This procedure changes the instrument from HART Universal Revision 5 to HART Universal Revision 7 (or vice versa). Before proceeding, verify that your systems are prepared to support HART Universal Revision 7 devices. Follow the prompts on the Field Communicator display.

Section 4 Calibration

Calibration Overview

When a DVC6000 HW2 digital valve controller is ordered as part of a control valve assembly, the factory mounts the remote feedback unit on the actuator and connects the necessary tubing, then sets up and calibrates the controller.

For digital valve controllers that are ordered separately, recalibration of the analog input or pressure sensors generally is unnecessary. However, after mounting on an actuator, perform the initial setup then calibrate travel by selecting *Configure* > *Calibration* > *Travel Calibration* > *Auto Calibration*. For more detailed calibration information, refer to the following calibration procedures.

Field Communicator	Configure > Calibration (2-4)

Auto Travel Calibration - see page 42

Manual Travel Calibration - see page 44

Pushbutton Calibration - see page 45

Pressure Sensor Calibration - see page 46

Travel Sensor Calibration - see page 47

Analog Input Calibration - see page 51

Relay Adjustment - see page 52

PST Calibration (ODV Instrument Level only) - see page 54

Note

The Instrument Mode must be Out Of Service and the Protection set to None before the instrument can be calibrated.

If you are operating in burst mode, we recommend that you disable burst before continuing with calibration. Once calibration is complete, burst mode may then be turned back on.

⚠ WARNING

During calibration the valve will move full stroke. To avoid personal injury and property damage caused by the release of pressure or process fluid, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

Travel Calibration

If a double-acting relay is used, you will be prompted to run the relay adjustment when auto or manual calibration is selected. Select Yes to adjust the relay, select No to proceed with calibration. For additional information, refer to Relay Adjustment on page 52.

Auto Calibration

User interaction is only required with Auto Calibrate Travel when the feedback connection is SStem - Standard (Sliding Stem - Standard). A feedback connection of Rotary - All, SStem - Roller (Sliding Stem - Roller) requires no user interaction and you can start with step 6.

For a SStem - Standard feedback connection, interaction provides a more accurate crossover adjustment. Setting crossover establishes the zero degree point for the geometric correction used to translate the rotary motion observed by the travel sensor into the linear motion of the sliding-stem valve.

1. Select the method of crossover adjustment: manual, last value, or default. Manual is the recommended choice. If you select Manual, the Field Communicator will prompt you to adjust the crossover in step 3.

   If you select Last Value, the crossover setting currently stored in the instrument is used and there are no further user interactions with the auto-calibration routine (go to step 6). Use this selection if you cannot use manual, such as when you cannot see the valve.

   If you select Default, an approximate value for the crossover is written to the instrument and there are no further user interactions with the auto-calibration routine (go to step 6). Use this selection only as a last resort. Default assumes a midrange position on the travel sensor as the crossover point, however, this may not be an appropriate value to use for crossover because of variations in mounting and travel sensor calibration.

2. The instrument seeks the high and low drive points and the minor loop feedback (MLFB) and output bias. No user interaction is required in this step. For a description of these actions see step 6.

3. If you select Manual in step 1, you are asked to select an adjustment source, either analog or digital. If you use a current source to adjust the crossover, select Analog and go to step 4. If you wish to adjust the current source digitally, select Digital and go to step 5.

4. If you selected Analog as the crossover adjustment source, the Field Communicator prompts you to adjust the current source until the feedback arm is 90° to the actuator stem, as shown in figure 4-1. After you have made the adjustment, press OK and go to step 6.

5. If you selected Digital as the crossover adjustment source, the Field Communicator displays a menu to allow you to adjust the crossover.

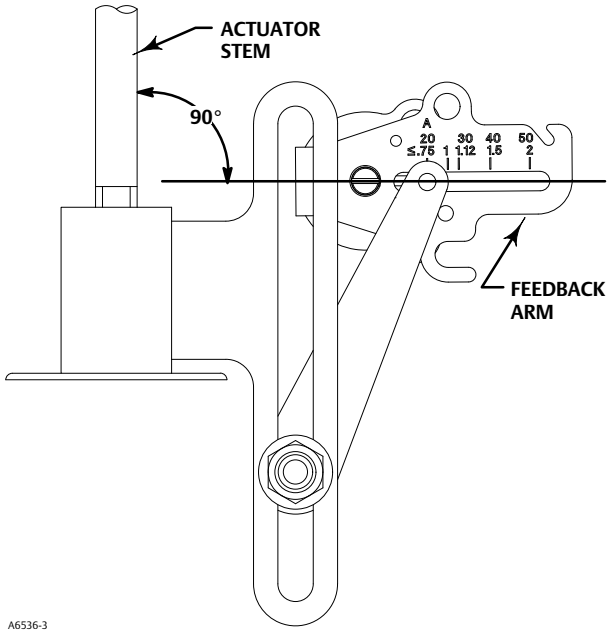
   Select the direction and size of change required to set the feedback arm so it is 90° to the actuator stem, as shown in figure 4-1. Selecting large, medium, and small adjustments to the crossover causes changes of approximately 10.0°, 1.0°, and 0.1°, respectively, to the rotation of the feedback arm.

   If another adjustment is required, repeat step 5. Otherwise, select Done and go to step 6.

6. The remainder of the auto calibration procedure is automatic. It is completed when the *Calibration* menu appears.

   During calibration, the instrument seeks the high and low end points and the minor loop feedback (MLFB) and output bias. By searching for the end points, the instrument establishes the limits of physical travel, i.e. the actual travel 0 and 100% positions. This also determines how far the relay beam swings to calibrate the sensitivity of the MLFB sensor.

Figure 4-1. Crossover Point



7. Place the instrument In Service and verify that the travel properly tracks the current source.

   If the unit does not calibrate, refer to table 4-1 for error messages and possible remedies.

Table 4-1. Auto Calibrate Travel Error Messages

Error Message	Possible Problem and Remedy
Power failure occurred during Auto Calib	The analog input signal to the instrument must be greater than 3.8 mA. Adjust the current output from the control system or the current source to provide at least 4.0 mA.
Auto Calib did not complete within the time limit.	The problem may be one or the other of the following: 1. The tuning set selected is too low and the valve does not reach an end point in the allotted time. Select *Manual Setup* > *Tuning* > *Travel Tuning* > *Stabilize/Optimize* then *Increase Response* (selects next higher tuning set). 2. The tuning set selected is too high, valve operation is unstable and does not stay at an end point for the allotted time. Select *Manual Setup* > *Tuning* > *Travel Tuning* > *Stabilize/Optimize* then *Decrease Response* (selects next lower tuning set).
Insufficient travel	Prior to receiving this message, did the instrument output go from zero to full supply? If not, verify instrument supply pressure by referring to the specifications in the appropriate actuator instruction manual. If supply pressure is correct, check instrument pneumatic components (I/P converter and relay). If the instrument output did go from zero to full supply prior to receiving this message, then verify proper mounting by referring to the appropriate mounting procedure in the Installation section. Verify travel sensor adjustment by performing the appropriate Travel Sensor Adjust procedure in the Calibration section. Making the crossover adjustment with the valve positioned at either end of its travel will also cause this message to appear.
Drive signal exceed low limit; check supply pressure	1. Check supply pressure (reverse-acting relay) 2. Friction is too high.
Drive signal exceed high limit; check supply pressure	1. Check supply pressure (direct-acting relay) 2. Friction is too high

Manual Calibration

Two procedures are available to manually calibrate travel:

- Analog Adjust— This procedure is used when you can manually change the 4-20 mA current source to move the valve.
- Digital Adjust— This procedure is used when the 4-20 mA current source cannot be manually changed.

Analog Calibration Adjust

Connect a variable current source to the instrument LOOP + and LOOP - terminals. The current source should be capable of generating 4 to 20 mA.

Follow the prompts on the Field Communicator display to calibrate the instrument's travel in percent.

Note
0% Travel = Valve Closed
100% Travel = Valve Open

1. Adjust the input current until the valve is near mid-travel. Press OK.

Note
In steps 2 through 7 the accuracy of the current source adjustment affects the position accuracy.

2. Adjust the current source until the valve is at 0% travel, then press OK.
3. Adjust the current source until the valve is at 100% travel, then press OK.
4. Adjust the current source until the valve is at 0% travel, then press OK.
5. Adjust the current source until the valve is at 100% travel, then press OK.
6. Adjust the current source until the valve is at 5% travel, then press OK.
7. Adjust the current source until the valve is at 95% travel, then press OK.
8. Place the instrument In Service and verify that the travel properly tracks the current source.

Digital Calibration Adjust

Connect a variable current source to the instrument LOOP + and LOOP - terminals. The current source should be set between 4 and 20 mA.

Follow the prompts on the Field Communicator display to calibrate the instrument's travel in percent.

1. Adjust the input current until the valve is near mid-travel. Press OK.

Note
0% Travel = Valve Closed
100% Travel = Valve Open

2. From the adjustment menu, select the direction and size of change required to set the travel at 0%.
   Selecting large, medium, and small adjustments causes changes of approximately 10.0%, 1.0%, and 0.1%, respectively. If another adjustment is required, repeat step 2. Otherwise, select Done and go to step 3.
3. From the adjustment menu, select the direction and size of change required to set the travel to 100%.
   If another adjustment is required, repeat step 3. Otherwise, select Done and go to step 4.
4. From the adjustment menu, select the direction and size of change required to set the travel at 0%.
   If another adjustment is required, repeat step 4. Otherwise, select Done and go to step 5.
5. From the adjustment menu, select the direction and size of change required to set the travel to 100%.
   If another adjustment is required, repeat step 5. Otherwise, select Done and go to step 6.
6. From the adjustment menu, select the direction and size of change required to set the travel to 5%.
   If another adjustment is required, repeat step 6. Otherwise, select Done and go to step 7.
7. From the adjustment menu, select the direction and size of change required to set the travel to 95%.
   If another adjustment is required, repeat step 7. Otherwise, select Done and go to step 8.
8. Place the instrument In Service and verify that the travel properly tracks the current source.

Pushbutton Calibration

A pushbutton near the wiring terminals in the terminal box provides a quick means to autocalibrate the instrument. The button must be pressed for 3 to 10 seconds. Autocalibration will move the valve through the full range of travel whether the Instrument Mode is In Service or Out of Service. However, if the Write Protection is Protected, this button will not be active. To abort, press the button again for 1 second. The calibration button is disabled by default. To enable it, go to *Manual Setup* > *Instrument* > *Calibration Button*.

Note

Pressure range (used for Pressure Fallback) is not recalibrated during this procedure.

This calibration procedure is recommended whenever the I/P converter or pneumatic relay is replaced. Do not use the pushbutton calibration for initial calibration when mounting the instrument on an actuator, or if the printed wiring board assembly was replaced.

If you suspect calibration has changed due to drift, first perform a Valve Signature diagnostic test using ValveLink software to capture the as-found data for future root cause analysis.

Sensor Calibration

Pressure Sensors

Note

The pressure sensor is calibrated at the factory and should not require calibration.

Output Pressure Sensor

To calibrate the output pressure sensor, connect an external reference gauge to the output being calibrated. The gauge should be capable of measuring maximum instrument supply pressure. Depending upon the sensor you wish to calibrate, select either *Output A Sensor* or *Output B Sensor.* Follow the prompts on the Field Communicator display to calibrate the instrument's output pressure sensor.

1. Adjust the supply pressure regulator to the maximum instrument supply pressure. Press OK.
2. The instrument reduces the output pressure to 0. The following message appears.

   > Use the Increase and Decrease selections until the displayed pressure matches the output x pressure.

   Press OK when you have read the message.
3. The value of the output pressure appears on the display. Press OK to display the adjustment menu.
4. From the adjustment menu, select the direction and size of adjustment to the displayed value.

   Selecting large, medium, and small adjustments causes changes of approximately 3.0 psi/0.207 bar/20.7 kPa, 0.30 psi/0.0207 bar/2.07 kPa, and 0.03 psi/0.00207 bar/0.207 kPa, respectively.

   If the displayed value does not match the output pressure, press OK, then repeat this step (step 4) to further adjust the displayed value. When the displayed value matches the output pressure, select Done and go to step 5.
5. The instrument sets the output pressure to full supply. The following message appears.

   > Use the Increase and Decrease selections until the displayed pressure matches the output x pressure.

   Press OK when you have read the message.
6. The value of the output pressure appears on the display. Press OK to display the adjustment menu.
7. From the adjustment menu, select the direction and size of adjustment to the displayed value. If the displayed value does not match the output pressure, press OK, then repeat this step (step 7) to further adjust the displayed value. When the displayed value matches the output pressure, select Done and go to step 8.
8. Place the instrument In Service and verify that the displayed pressure matches the measured output pressure.

Supply Pressure Sensor

Note

Supply Pressure Sensor Calibration is not available for instrument level HC.

To calibrate the supply pressure sensor, connect an external reference gauge to the output side of the supply regulator. The gauge should be capable of measuring maximum instrument supply pressure. Follow the prompts on the Field Communicator display to calibrate the instrument's supply pressure sensor.

1. Select a) Zero Only, or b) Zero and Span (gauge required).

   a. If Zero Only calibration is selected, adjust the supply pressure regulator to remove supply pressure from the instrument. Press OK. Once calibration is complete, go to step 5.

   b. If Zero and Span calibration is selected, adjust the supply pressure regulator to remove supply pressure from the instrument. Press OK. Adjust the supply regulator to the maximum instrument supply pressure. Press OK. Proceed with step 2.

2. The following message appears:

   > Use the Increase and Decrease selections until the displayed pressure matches the supply pressure.

   Press OK when you have read this message.

3. The value of the pressure appears on the display.
4. From the adjustment menu, select the direction and size of adjustment to the displayed value.

   Selecting large, medium, and small adjustments causes changes of approximately 3.0 psi/0.207 bar/20.7 kPa, 0.30 psi/0.0207 bar/2.07 kPa, and 0.03 psi/0.00207 bar/0.207 kPa, respectively.

   Adjust the displayed value until it matches the supply pressure, select Done and go to step 5.

5. Place the instrument In Service and verify that the displayed pressure matches the measured supply pressure.

Travel Sensor

The travel sensor is normally adjusted at the factory and should not require adjustment. However, if the travel sensor has been replaced, adjust the travel sensor by performing the appropriate procedure. See the Maintenance section for travel sensor assembly replacement procedures.

DVC6015 and DVC6035 Remote Feedback Units

⚠ WARNING

Failure to remove air pressure may cause personal injury or property damage from bursting parts.

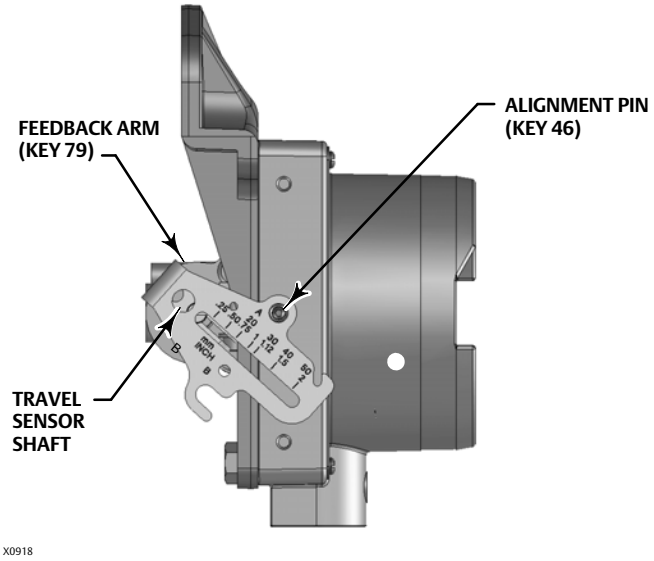
1. Remove supply air and remove the instrument from the actuator.

2. As shown in figure 4-2, align the feedback arm (key 79) with the housing by inserting the alignment pin (key 46) through the hole marked “A” on the feedback arm. Fully engage the alignment pin into the tapped hole in the housing.

Note

The alignment pin (key 46) is stored inside the remote feedback unit housing.

Figure 4-2. FIELDVUE DVC6015 Remote Feedback Unit Showing Feedback Arm in Position for Travel Sensor Adjustment



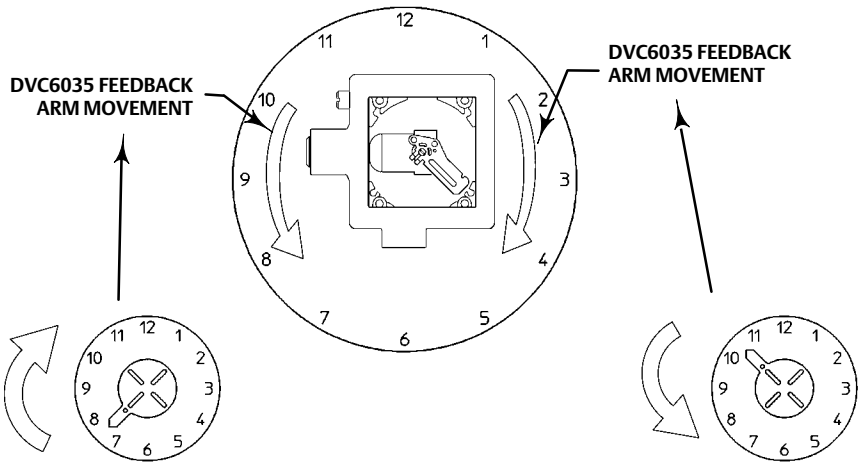
3. Loosen the screw that secures the feedback arm to the travel sensor shaft. Position the feedback arm so that the surface of the feedback arm is flush with the end of the travel sensor shaft.
4. Connect a current source to the instrument LOOP - and LOOP + terminals. Set the current source to any value between 4 and 20 mA. Connect the Field Communicator to the TALK terminals.
5. Before beginning the travel sensor adjustment, set the instrument mode to Out Of Service and the protection to None.
6. From the *Calibrate* menu select *Sensor Calibration, Travel Sensor.* Follow the prompts on the Field Communicator display to adjust the travel sensor counts to the value listed in table 4-2.

Table 4-2. Travel Sensor Counts

Remote Feedback Unit	Travel Sensor Counts
DVC6015	700 ±200
DVC6025	2100 ±200
DVC6035 Counterclockwise shaft rotation(1)	600 ±200
DVC6035 Clockwise shaft rotation(1)	3400 ±200

1. Refer to figure 4-3 to determine the desired starting position for the DVC6035 based on potentiometer shaft; counterclockwise or clockwise.

Figure 4-3. Travel Indicator Assembly Starting Position; Counterclockwise or Clockwise



ACTUATOR SHAFT MOVEMENT

STARTING POSITION OF THE TRAVEL INDICATOR ASSEMBLY IF INCREASING PRESSURE FROM OUTPUT A DRIVES THE INDICATOR CLOCKWISE. THE POTENTIOMETER SHAFT WILL ROTATE COUNTERCLOCKWISE AS VIEWED FROM THE BACK OF THE INSTRUMENT.

ACTUATOR SHAFT MOVEMENT

STARTING POSITION OF THE TRAVEL INDICATOR ASSEMBLY IF INCREASING PRESSURE FROM OUTPUT A DRIVES THE INDICATOR COUNTERCLOCKWISE. THE POTENTIOMETER SHAFT WILL ROTATE CLOCKWISE AS VIEWED FROM THE BACK OF THE INSTRUMENT.

Note

In the next step, be sure the feedback arm surface remains flush with the end of the travel sensor shaft.

7. While observing the travel sensor counts, tighten the screw that secures the feedback arm to the travel sensor shaft. Be sure the travel sensor counts remain within the tolerances listed in table 4-2. Paint the screw to discourage tampering with the connection.
8. Disconnect the Field Communicator and current source from the instrument.
9. Remove the alignment pin and store it in the instrument housing.
10. Install the remote feedback unit on the actuator.

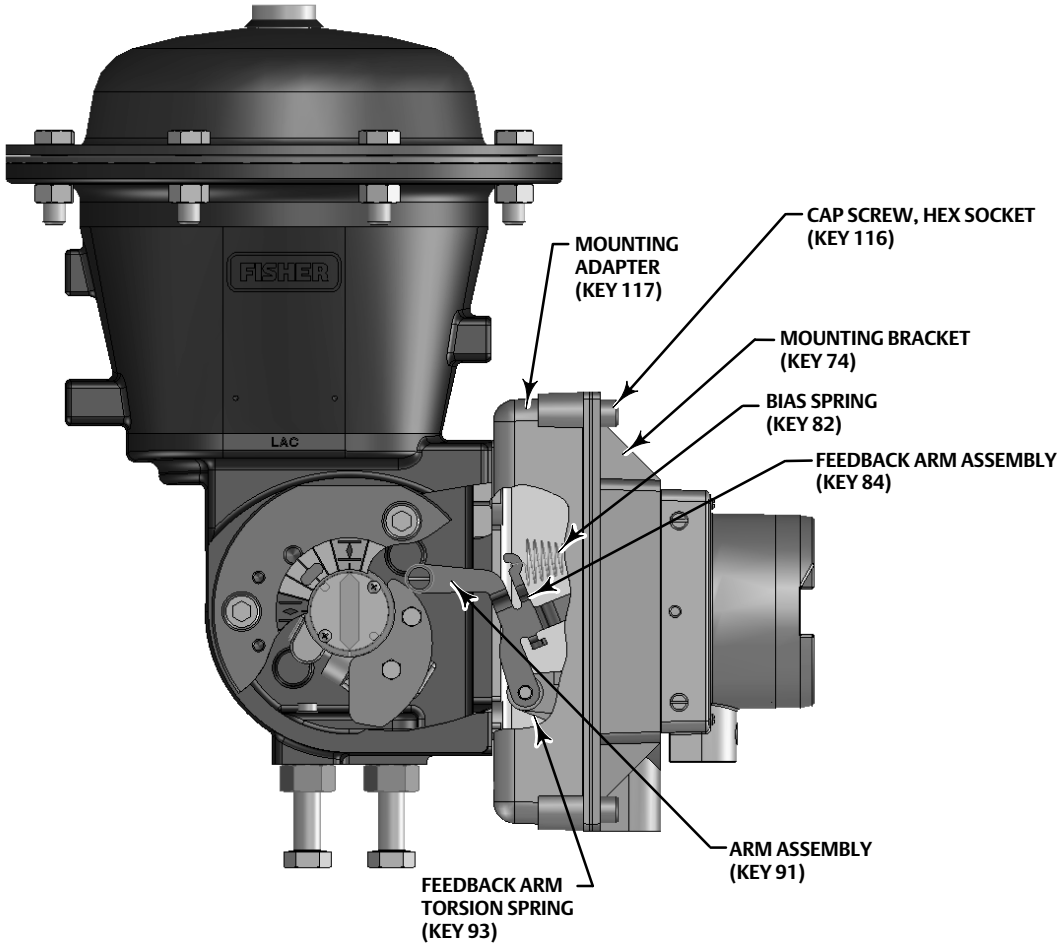
DVC6025 Remote Feedback Unit

⚠ WARNING

Failure to remove air pressure may cause personal injury or property damage from bursting parts.

1. Remove supply air and remove the instrument from the actuator.
2. See figure 4-4 for parts identification. Disconnect the bias spring (key 82) from the feedback arm assembly (key 84) and the arm assembly (key 91). Remove the mounting bracket (key 74) from the back of the feedback unit. Hold the arm assembly (key 91) so that the arm assembly points toward the terminal box and the arm is parallel to the back of the housing, as shown in figure 4-5.

Figure 4-4. FIELDVUE DVC6025 Digital Valve Controller Mounted on Fisher 2052, Size 33 Actuator



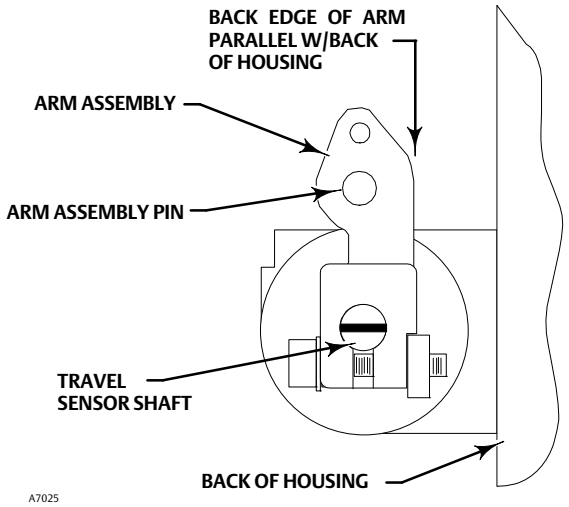
3. Loosen the screw that secures the arm assembly to the travel sensor shaft. Position the arm assembly so that the outer surface is flush with the end of the travel sensor shaft.
4. Connect a current source to the instrument LOOP - and LOOP + terminals. Set the current source to any value between 4 and 20 mA. Connect the Field Communicator to the TALK terminals.
5. Before beginning the travel sensor adjustment, set the instrument mode to Out Of Service and the protection to None.
6. From the *Calibrate* menu, select *Sensor Calibration, Travel Sensor*. Follow the prompts on the Field Communicator display to adjust the travel sensor counts to the value listed in table 4-2.

Note

In the next step, be sure the arm assembly outer surface remains flush with the end of the travel sensor shaft.

7. While observing the travel sensor counts, tighten the screw that secures the arm assembly to the travel sensor shaft. Be sure the travel sensor counts remain within the tolerances listed in table 4-2. Paint the screw to discourage tampering with the connection.
8. Disconnect the Field Communicator and current source from the instrument.
9. Apply lubricant (key 63) to the pin portion of the arm assembly (key 91).
10. Replace the mounting bracket on the back of the instrument and reconnect the bias spring between the feedback arm assembly and the arm assembly on the travel sensor shaft.
11. Install the remote feedback unit on the actuator.

Figure 4-5. FIELDVUE DVC6025 Travel Sensor Arm/Housing Back Plane Alignment



Analog Input Calibration

To calibrate the analog input sensor, connect a variable current source to the instrument LOOP+ and LOOP- terminals. The current source should be capable of generating an output of 4 to 20 mA. Follow the prompts on the Field Communicator display to calibrate the analog input sensor.

1. Set the current source to the target value shown on the display. The target value is the Input Range Low value. Press OK.
2. The following message appears:

> Use the Increase and Decrease selections until the displayed current matches the target.

Press OK when you have read this message.

3. The value of the Analog Input appears on the display. Press OK to display the adjustment menu.
4. From the adjustment menu, select the direction and size of adjustment to the displayed value.

   Selecting large, medium, and small adjustments causes changes of approximately 0.4 mA, 0.04 mA, and 0.004 mA, respectively.

   If the displayed value does not match the current source, press OK, then repeat this step (step 4) to further adjust the displayed value. When the displayed value matches the current source, select Done and go to step 5.
5. Set the current source to the target value shown on the display. The target value is the Input Range High value. Press OK.
6. The following message appears:

   > Use the Increase and Decrease selections until the displayed current matches the target.

   Press OK when you have read this message.
7. The value of the Analog Input appears on the display. Press OK to display the adjustment menu.
8. From the adjustment menu, select the direction and size of adjustment to the displayed value. If the displayed value does not match the current source, press OK, then repeat this step (step 8) to further adjust the displayed value. When the displayed value matches the current source, select Done and go to step 9.
9. Place the instrument In Service and verify that the analog input displayed matches the current source.

Relay Adjustment

Before beginning travel calibration, check the relay adjustment. Replace the instrument cover when finished.

Note

Relay B and C are not user-adjustable.

Double-Acting Relay

The double-acting relay is designated by “Relay A” on a label affixed to the relay itself. For double-acting actuators, the valve must be near mid-travel to properly adjust the relay. The Field Communicator will automatically position the valve when *Relay Adjust* is selected.

CAUTION

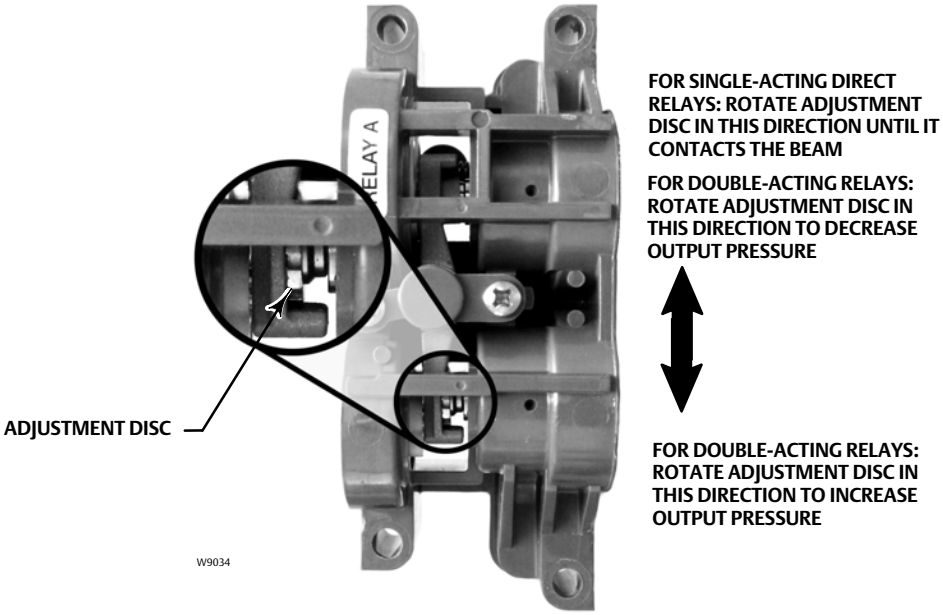
Care should be taken during relay adjustment as the adjustment disc may disengage if rotated too far.

Rotate the adjustment disc, shown in figure 4-6, until the output pressure displayed on the Field Communicator is between 50 and 70% of supply pressure. This adjustment is very sensitive. Be sure to allow the pressure reading to stabilize before making another adjustment (stabilization may take up to 30 seconds or more for large actuators).

If the low bleed relay option has been ordered stabilization may take approximately two minutes longer than the standard relay.

Relay A may also be adjusted for use in single-acting- direct applications. Rotate the adjustment disc as shown in figure 4-6 for single-acting direct operation.

Figure 4-6. Relay A Adjustment (Shroud Removed for Clarity)


RELAY A
ADJUSTMENT DISC
W9034
FOR SINGLE-ACTING DIRECT RELAYS: ROTATE ADJUSTMENT DISC IN THIS DIRECTION UNTIL IT CONTACTS THE BEAM
FOR DOUBLE-ACTING RELAYS: ROTATE ADJUSTMENT DISC IN THIS DIRECTION TO DECREASE OUTPUT PRESSURE
FOR DOUBLE-ACTING RELAYS: ROTATE ADJUSTMENT DISC IN THIS DIRECTION TO INCREASE OUTPUT PRESSURE

Single-Acting Relays

⚠ WARNING

For Instrument Level ODV only:

If the unused port is monitoring pressure, ensure that the pressure source conforms to ISA Standard 7.0.01 and does not exceed the pressure supplied to the instrument.

Failure to do so could result in personal injury or property damage caused by loss of process control.

Single-Acting Direct Relay

The single-acting direct relay is designated by “Relay C” on a label affixed to the relay itself. Relay C requires no adjustment.

Single-Acting Reverse Relay

The single-acting reverse relay is designated by “Relay B” on a label affixed to the relay itself. Relay B is calibrated at the factory and requires no further adjustment.

PST Calibration (ODV Instrument Level only)

This procedure permits you to run the Partial Stroke Calibration, which enables the Partial Stroke Test. It establishes values for Partial Stroke Pressure Limit, Pressure Set Point and Pressure Saturation Time for End Point Pressure Control, Travel Deviation Alert Point and Travel Deviation Time. The Partial Stroke Calibration also sets default values for max travel movement, test speed, and test pause time.

Note

You must take the instrument out of service before running Partial Stroke Calibration.

Ensure that the instrument is put back in service after the completing the calibration procedure.

Section 5 Device Information, Diagnostics, and Alerts

Overview

Field Communicator	Overview (1)

Status & Primary Purpose Variables

The overview section provides basic information about the current state of the instrument and gives you access to the current values of:

- Alert Status
- Communication Status
- Instrument Mode (In/Out of Service)
- Analog Input
- Setpoint
- Travel
- Supply Pressure (not available in Instrument Level HC)
- Actuator Pressure(s)
- Travel/Pressure Control Configuration

Device Information

Device Information provides details about the instrument construction including:

- Tag Name
- Instrument Model Number
- Instrument Level (see table 5-1)
- Device ID (unique number used to prevent the instrument from accepting commands intended for other instruments)
- Serial Numbers
- Firmware, DD, and Hardware Revisions
- HART Universal Revision
- Write Protection (provides a procedure to enable/disable)

Table 5-1. Functions Available for Instrument Level

Instrument Level	Functions Available
HC	HART Communicating: Communicates with the Field Communicator and ValveLink software. In addition, HC provides: travel cutoffs and limits, minimum opening and closing times, input characterization (linear, equal percentage, quick opening, and custom), trending with ValveLink Solo, and the following alerts: travel deviation; travel alert high, low, high high, and low low; drive signal; cycle counter; and travel accumulation.
AD	Advanced Diagnostics: Includes all functions listed above plus (with ValveLink software) all offline diagnostic tests (dynamic error band, drive signal, step response, and valve signature) plus online trending
PD	Performance Diagnostics: Includes all functions listed above plus all Performance Diagnostics online/in-service valve testing (valve friction, electronics, and mechanical condition)
ODV	Optimized Digital Valve: Includes all functions listed above plus partial stroke test and lead/lag set point filter

Service Tools

Field Communicator	Service Tools (3)

Device Status

Instrument alerts, when enabled, detect many operational and performance issues that may be of interest. If there are no alerts currently active, this display will be empty.

Alert Record

The DVC6000 HW2 will store 20 alerts. Once the alert record is full, no additional alerts will be stored until the record is cleared.

Below is a list of the alerts that can be detected by the instrument. To enable or disable the alerts, navigate to *Configure > Alert Setup*.

- Offline/Failed Alert—This alert is active if a shutdown alert has put the device in a failed state and is therefore not controlling the input. Press Enter to view the alert(s) that caused the shutdown.

Electronics

- Drive Current Failure—This alert is active when the drive current to the I/P converter is not flowing as expected. If this alert occurs, check the connection between the I/P converter and the printed wiring board assembly. Try removing the I/P converter and re-installing it. If the alert does not clear, replace the I/P converter or the printed wiring board assembly.

- Drive Signal Alert—This alert monitors the drive signal and calibrated travel. If one of the following conditions exists for more than 20 seconds, the alert is set.

  For the case where Zero Power Condition is defined as closed:
  Drive Signal < 10% and Calibrated Travel > 3%
  Drive Signal > 90% and Calibrated Travel < 97%

  For the case where Zero Power Condition is defined as open:
  Drive Signal < 10% and Calibrated Travel < 97%
  Drive Signal > 90% and Calibrated Travel > 3%

- Non-Critical NVM Alert—This alert is active if there is a failure associated with NVM (non-volatile memory) that is not critical for instrument operation. If this alert is active, restart the instrument. If the alert persists, replace the printed wiring board assembly.

- Critical NVM Alert—This alert is active if there is a failure associated with NVM that is critical for instrument operation. If this alert is active, restart the instrument. If the alert persists, replace the printed wiring board assembly.

- Flash Integrity Failure—This alert is active if there is a failure associated with flash ROM (read only memory). If this alert is active, restart the instrument. If the alert persists, replace the printed wiring board assembly.

- Reference Voltage Failure—This alert is active if there is a failure associated with the internal voltage reference. If this alert is active, replace the printed wiring board assembly.

- Variable Out of Range—This alert is active if one or more of the measured analog sensor readings (loop current, pressure, temperature, or travel) is saturated or reading out of its configured range. The condition may be due to improper configuration or physical setup and not be due to a sensor malfunction.
- Field Device Malfunction—This alert is active if the pressure, position, or temperature sensors are providing invalid readings.
- Internal Sensor Out of Limits—This alert is active if there is a problem with either the pressure sensor or the printed wiring board assembly.
- Travel Sensor Alert—This alert is active if the sensed travel is outside the range of -25.0 to 125.0% of calibrated travel. If this alert is active, check the instrument mounting. Also, check that the electrical connection from the travel sensor is properly plugged into the printed wiring board assembly. After restarting the instrument, if the alert persists, troubleshoot the printed wiring board assembly or travel sensor.
- Temperature Sensor Alert—This alert is active when the instrument temperature sensor fails, or the sensor reading is outside of the range of -60 to 100°C (-76 to 212°F). The temperature reading is used internally for temperature compensation of inputs. If this alert is active, restart the instrument. If the alert persists, replace the printed wiring board assembly.
- Pressure Sensor Alert—This alert is active if any of the 3 pressure sensor readings are outside the range of -24.0 to 125.0% of the calibrated pressure for more than 60 seconds. If this alert is active, check the instrument supply pressure, ensure the printed wiring board assembly is properly mounted onto the module base assembly, and ensure the pressure sensor O-rings are properly installed. If the alert persists after restarting the instrument, replace the printed wiring board assembly.
- Minor Loop Sensor Alert—This alert is active if the pneumatic relay position reading is outside the valid range. If the alert persists, replace the printed wiring board.
- Loop Current Validation Alert—This alert is active if the loop current is significantly out of range, or if there is a problem with the analog circuit electronics. If this alert is active, restart the instrument with the loop current verified to be in the 4-20 mA range. If the alert persists, replace the printed wiring board.

Note
If the control system is known to output current 24 mA or above, Shutdown on Loop Current Validation should not be enabled.

- Output Circuit Communication Failure—This alert is active if the output circuit is not responding. If configured as a position transmitter output, first make sure the transmitter circuit is powered. If the alert persists, make sure the DIP switch on the main electronics matches the configuration of the OUT terminals. If the alert is still active, replace the main electronics.
- Instrument Time is Approximate Alert—This alert is active if the instrument has been powered down since the last time the instrument clock was set. To clear the alert, reset the instrument time.

Pressure

- Supply Pressure Alert—This alert is active if the supply pressure falls below the supply pressure alert point.

Note
The Supply Pressure Lo alert is available for instrument level AD, PD, and ODV.

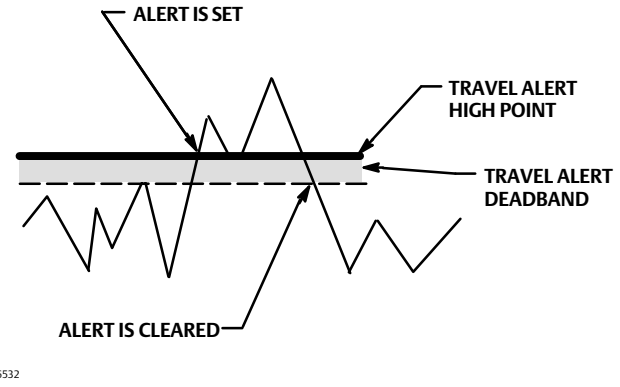
Travel

Note

The Travel Alert Deadband applies to the Travel Deviation Alert as well as the Travel Alert Hi, Lo, Hi Hi, and Lo Lo.

- Travel Deviation Alert—If the difference between the Travel Target and the Travel exceeds the Travel Deviation Alert Point for more than the Travel Deviation Time, the Travel Deviation Alert is active. It remains active until the difference between the travel target and the Travel is less than the Travel Deviation Alert Point minus the Travel Alert Deadband.
- Travel Alert Hi—This alert is active when the Travel exceeds the Travel Alert Hi Point. Once the alert is active, the alert will clear when the Travel falls below the Travel Alert Hi Point minus the Travel Alert Deadband. See figure 5-1.

Figure 5-1. Travel Alert Deadband



- Travel Alert Hi Hi—This alert is active when the Travel exceeds the Travel Alert Hi Hi Point. Once the alert is active, the alert will clear when the Travel falls below the Travel Alert Hi Hi Point minus the Travel Alert Deadband.
- Travel Alert Lo—This alert is active when the Travel is below the Travel Alert Lo Point. Once the alert is active, the alert will clear when the Travel exceeds the Travel Alert Lo Point plus the Travel Alert Deadband.
- Travel Alert Lo Lo—This alert is active when the Travel is below the Travel Alert Lo Lo Point. Once the alert is active, the alert will clear when the Travel exceeds the Travel Alert Lo Lo Point plus the Travel Alert Deadband.
- Travel Limit/Cutoff Hi Alert—This alert is active when the Travel exceeds the Hi Limit/Cutoff Point.
- Travel Limit/Cutoff Lo Alert—This alert is active when the Travel falls below the Lo Limit/Cutoff Point.
- Integrator Saturated High Alert—This alert is active if the instrument integrator is saturated at the high extreme.
- Integrator Saturated Low Alert—This alert is active if the instrument integrator is saturated at the low extreme.
- Pressure Fallback Active Alert—This alert is active when the instrument has detected a problem with the travel feedback and is now controlling the output like an I/P transducer.

Travel History

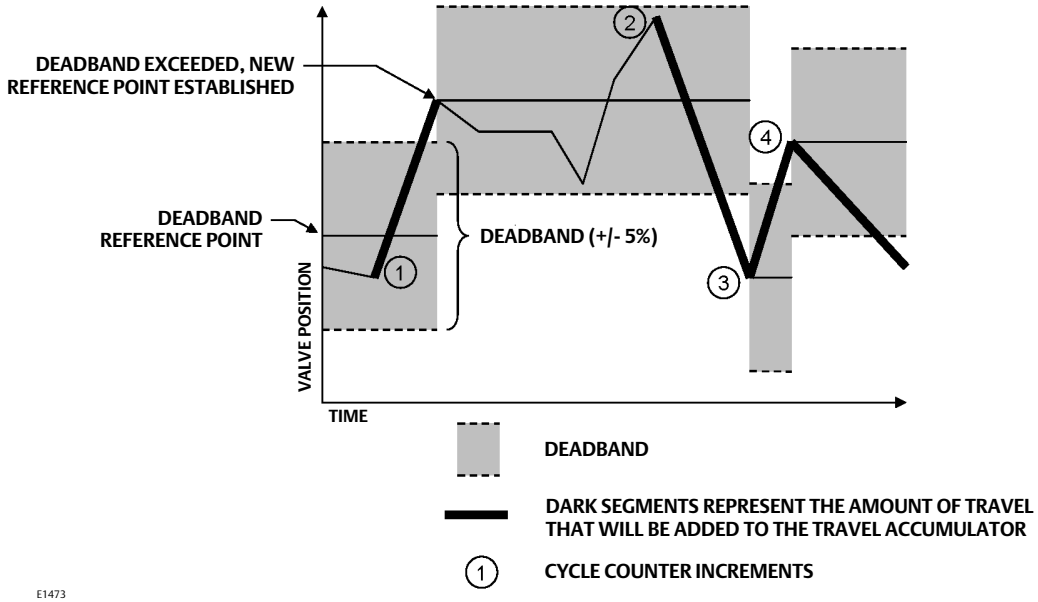
- Cycle Count High Alert—This alert is active if the Cycle Counter exceeds the Cycle Count Alert Point. The Cycle Count records the number of times the travel changes direction when it is outside of the deadband. To clear the alert, set the Cycle Counter to a value less than the alert point.
- Travel Accumulator High Alert—This alert is active if the Travel Accumulator exceeds the Travel Accumulator Alert Point. The Travel Accumulator totalizes the travel of the valve when the deadband is exceeded. To clear the alert, set the Travel Accumulator to a value less than the alert point.

Note

The Cycle Count / Travel Accumulator Deadband applies to both the Cycle Count High Alert and the Travel Accumulator High Alert.

The deadband is the percent (%) of ranged travel around a travel reference point. The travel reference point gets re-established to the point of travel reversal that occurs outside of the deadband. The deadband must be exceeded before a change in travel direction will be counted as a cycle and the accumulated travel (up to the point of travel reversal) is added to the total accumulation. See figure 5-2.

Figure 5-2. Cycle Counter and Travel Accumulator Deadband Example (set at 10%)



Alert Record

- Alert Record Not Empty Alert—This alert is active when there are 1 or more alerts stored in the alert record.
- Alert Record Full Alert—This alert is active when the alert record is full. Additional alerts that are detected will not be saved to the alert record until the alert record is cleared.

Status

- Calibration in Progress Alert—This alert is active when calibration is in progress.
- AutoCal in Progress Alert—This alert is active when auto calibration is in progress.
- Diagnostic in Progress Alert—This alert is active when a diagnostic test is in progress.
- Diagnostic Data Available Alert—This alert is active when diagnostic data has been collected and is being stored in the instrument.
- Pressure Control Active Alert—This alert is active when the instrument is controlling like an I/P transducer (Pressure Control instead of Travel Control).

Diagnostics

Stroke Valve

Follow the prompts on the Field Communicator display to select from the following:

- Done—Select this if you are done. All ramping is stopped when DONE is selected.
- Ramp Open—ramps the travel toward open at the rate of 1.0% per second of the ranged travel.
- Ramp Closed—ramps the travel toward closed at the rate of 1.0% per second of the ranged travel.
- Ramp to Target—ramps the travel to the specified target at the rate of 1.0% per second of the ranged travel.
- Step to Target—steps the travel to the specified target.

Partial Stroke Test

Note
Partial Stroke Test is only available for instrument level ODV.

The Partial Stroke Test allows DVC6000 HW2 digital valve controllers with instrument level ODV to perform a Valve Signature type of test while the instrument is in service and operational. In some applications, it is important to be able to exercise and test the valve to verify that it will operate when commanded. This feature allows the user to partially stroke the valve while continually monitoring the input signal. If a demand arises, the test is aborted and the valve moves to its commanded position. The partial stroke valve travel is configurable between 1 and 30% maximum travel, in 0.1% increments. Data from the last partial stroke test is stored in the instrument memory for retrieval by ValveLink software.

The Partial Stroke Test allows you to perform a partial, 10%, stroke test (standard) or a custom stroke test. With the custom stroke test, the stroke may be extended up to 30%. Be sure to check plant guidelines before performing a custom stroke test. The purpose of this test is to ensure that the valve assembly moves upon demand.

A partial stroke test can be initiated when the valve is operating at either 4 or 20 mA (point-to-point mode). In applications where a spurious trip is to be minimized, 4 mA is the normal operating position.

When enabled, a partial stroke test may be initiated by the device (as a scheduled, auto partial stroke test), a remote pushbutton located in the field or at the valve, a Field Communicator, or ValveLink software.

- Automatic (Scheduled)

The Auto Partial Stroke Test allows the partial stroke test to be scheduled by the DVC6000 HW2. The test is scheduled in number of hours between tests. Any power cycle will reset the test clock timer.

- Local Pushbutton

A partial stroke test command may be sent to the digital valve controller using a set of contacts wired to the auxiliary +/- terminals. To perform a test, the contacts must be closed for 3 to 5 seconds and then opened. To abort the test, close the contacts for 1 second. The last set of diagnostic data is stored in the instrument memory for later retrieval via ValveLink software.

- Field Communicator

1. Connect the Field Communicator to the LOOP terminals on the DVC6005 HW2 base unit.
2. Turn on the Field Communicator.
3. From the *Online* menu, select *Service Tools* > *Diagnostics* > *Partial Stroke Test*.
4. Select either *Standard (10%)* or *Custom*. With the Custom Stroke Test, the stroke may be entered up to 30% with configurable stroking speed and pause time.
5. The currently configured Stroke, Stroking Speed, and Pause Time is displayed. Choose “Yes” to run the test using these values. Choose “No” to modify the values. The default value for Stroke Speed is 0.25%/second.
6. The valve begins to move and the actual travel reported by the digital valve controller is displayed on the Field Communicator.
7. Once the valve has reached the endpoint, check that the valve has reached the desired set point. The valve should return to its original position.

For information on configuring the Partial Stroke Test, see Partial Stroke Variables in the Detailed Setup section.

Variables

Field Communicator	Service Tools > Variables (3-4)

The Variables section provides current values of the instrument variables. Below is a list of the variables available for viewing:

- Write Protection (also provides a procedure to enable/disable)
- Instrument Mode (also provides a procedure to place in/out of service)
- Analog Input
- Setpoint
- Travel
- Drive Signal
- Input Characterization (also provides a procedure to modify)
- Cycle Counter
- Travel Accumulator
- Supply Pressure (not available in Instrument Level HC)

- Actuator Pressure(s)
- Travel/Pressure Control Configuration (also provides a procedure to modify)
- Control Mode (also provides a procedure to modify)
- Instrument Temperature
- Travel Counts (this is the raw travel sensor reading used for advanced adjustments)
- Maximum Recorded Temperature
- Minimum Recorded Temperature
- Number of Power Ups
- Days Powered Up

Section 6 Maintenance and Troubleshooting

The DVC6000 HW2 digital valve controller enclosure is rated Type 4X and IP66, therefore periodic cleaning of internal components is not required. If the DVC6000 HW2 is installed in an area where the exterior surfaces tend to get heavily coated or layered with industrial or atmospheric contaminants, however, it is recommended that the vent (key 52) be periodically inspected to ensure it is fully open. If the vent appears to be clogged, the vent can be removed, cleaned and replaced. Lightly brush the exterior of the vent to remove contaminant and run a mild water/detergent solution through the vent to ensure it is fully open.

⚠ WARNING

Personal injury or property damage can occur from cover failure due to overpressure. Ensure that the housing vent opening is open and free of debris to prevent pressure buildup under the cover.

⚠ WARNING

To avoid static discharge from the plastic cover when flammable gases or dust are present, do not rub or clean the cover with solvents. To do so could result in a spark that may cause the flammable gases or dust to explode, resulting in personal injury or property damage. Clean with a mild detergent and water only.

⚠ WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before performing any maintenance procedures on the DVC6000 HW2 digital valve controller:

- **Always wear protective clothing, gloves, and eyewear.**
- **Do not remove the actuator from the valve while the valve is still pressurized.**
- **Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve.**
- **Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.**
- **Check with your process or safety engineer for any additional measures that must be taken to protect against process media.**
- **Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression so the actuator is not applying force to the valve stem; this will allow for the safe removal of the stem connector.**
- **Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.**

When using natural gas as the supply medium, or for explosion proof applications, the following warnings also apply:

- **Remove electrical power before removing the housing cap. Personal injury or property damage from fire or explosion may result if power is not disconnected before removing the cap.**
- **Remove electrical power before disconnecting any of the pneumatic connections.**
- **When disconnecting any of the pneumatic connections or any pressure retaining part, natural gas will seep from the unit and any connected equipment into the surrounding atmosphere. Personal injury or property damage may result from fire or explosion if natural gas is used as the supply medium and appropriate preventive measures are not taken. Preventive measures may include, but are not limited to, one or more of the following: Remote venting of the unit, re-evaluating the hazardous area classification, ensuring adequate ventilation, and the removal of any ignition sources.**
- **Ensure that all caps and covers are correctly installed before putting this unit back into service. Failure to do so could result in personal injury or property damage from fire or explosion.**

CAUTION

When replacing components, use only components specified by the factory. Always use proper component replacement techniques, as presented in this manual. Improper techniques or component selection may invalidate the approvals and the product specifications, as indicated in table 1-2. It may also impair operations and the intended function of the device.

Note

If the feedback arm (key 79) or feedback arm assembly (key 84) is removed from the digital valve controller, the travel sensor must be recalibrated.

Because of the diagnostic capability of the DVC6000 HW2, predictive maintenance is available through the use of ValveLink software. Using the digital valve controller, valve and instrument maintenance can be enhanced, thus avoiding unnecessary maintenance. For information on using the ValveLink software, refer to the ValveLink software online help.

Module Base Maintenance

The digital valve controller contains a module base consisting of the I/P converter, printed wiring board assembly, and pneumatic relay. The module base may be easily replaced in the field without disconnecting field wiring or tubing.

Tools Required

Table 6-1 lists the tools required for maintaining the DVC6000 HW2 digital valve controller.

Table 6-1. Tools Required

Tool	Size	Component
Phillips Screwdriver		Relay, printed wiring board assembly, and cover screws
Hex key	5 mm	Terminal box screw
Hex key	1.5 mm	Terminal box cover screw
Hex key	2.5 mm	I/P converter screws
Hex key	5 mm	Travel sensor screws
Hex key	6 mm	Module base screws
Open-end wrench	1/2-inch	Connector Arm screw (DVC6015)
Hex key	9/64-inch	Feedback arm screw
Open-end wrench	7/16-inch	DVC6015 mounting bolts
Hex key	3/16-inch	DVC6025 mounting bolts

Removing the Module Base

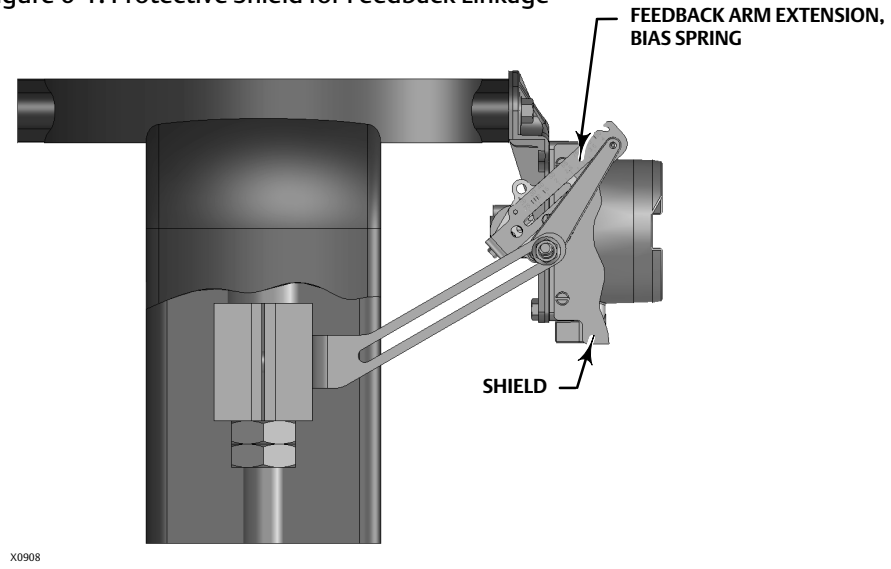
To remove the DVC6005 HW2 module base, perform the following steps. Refer to figure 7-2 for key number locations.

⚠ WARNING

To avoid personal injury or equipment damage from bursting of parts, turn off the supply pressure to the digital valve controller and bleed off any excess supply pressure before attempting to remove the module base assembly from the housing.

1. For sliding-stem applications only, a protective shield for the feedback linkage is attached to the side of the module base assembly as shown in figure 6-1. Remove this shield and keep for reuse on the replacement module. The replacement module will not have this protective shield.

Figure 6-1. Protective Shield for Feedback Linkage



2. Unscrew the four captive screws in the cover (key 43) and remove the cover from the module base (key 2).
3. Using a 6 mm hex socket wrench, loosen the three-socket head screws (key 38). These screws are captive in the module base by retaining rings (key 154).

Note

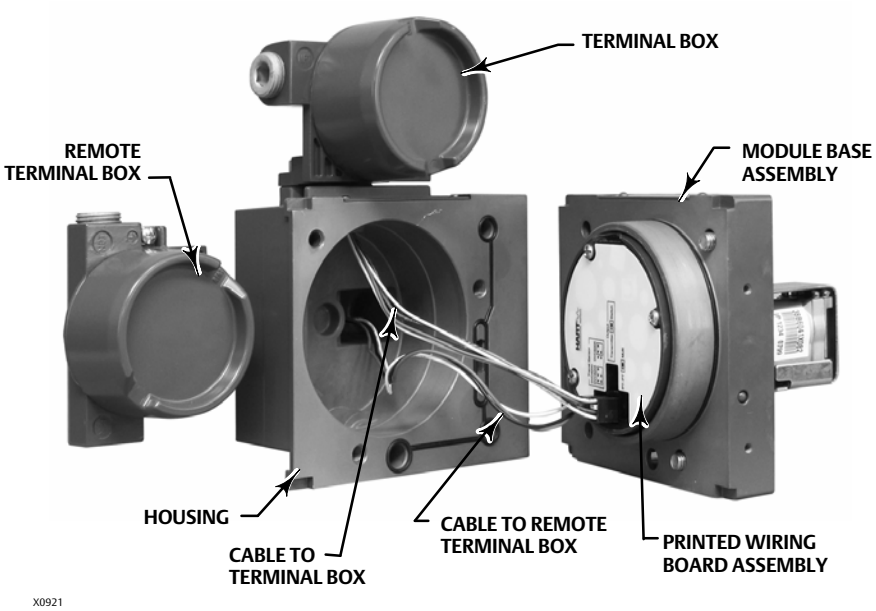
The module base is linked to the housing by two cable assemblies. Disconnect these cable assemblies after you pull the module base out of the housing.

4. Pull the module base straight out of the housing (key 1). Once clear of the housing, swing the module base to the side of the housing to gain access to the cable assemblies.
5. The base unit has two cable assemblies, shown in figure 6-2, which connect the module base, via the printed wiring board assembly, to the travel sensor and the terminal box. Disconnect these cable assemblies from the printed wiring board assembly on the back of the module base.

CAUTION

To avoid affecting performance of the instrument, take care not to damage the module base seal or guide surface. Do not bump or damage the bare connector pins on the PWB assembly. Damaging either the module base or guide surface may result in material damage, which could compromise the instruments ability to maintain a pressure seal.

Figure 6-2. Printed Wiring Board Cable Connections



Replacing the Module Base

To replace the DVC6005 HW2 module base perform the following steps. Refer to figure 7-2 for key number locations.

Note

To avoid affecting performance of the instrument, inspect the guide surface on the module and the corresponding seating area in the housing before installing the module base assembly. These surfaces must be free of dust, dirt, scratches, and contamination.

Ensure the module base seal is in good condition. Do not reuse a damaged or worn seal.

1. Ensure the module base seal (key 237) is properly installed in the housing (key 1). Ensure the O-ring (key 12) is in place on the module base assembly.
2. Connect the terminal box connector to the PWB assembly (key 50). Orientation of the connector is required.
3. Connect the travel sensor connector to the PWB assembly. Orientation of the connector is required.
4. Insert the module base (key 2) into the housing (key 1).
5. Install three socket head screws (key 38) in the module base into the housing. If not already installed, press three retaining rings (key 154) into the module base. Evenly tighten the screws in a crisscross pattern to a final torque of 16 N•m (138 lbf•in).

⚠ WARNING

Personal injury, property damage, or disruption of process control can result if the cable assemblies/wiring are damaged when attaching the cover to the module base assembly.

Ensure that the cable assemblies/ wiring are positioned in the cavity of the module base so they do not get compressed or damaged when attaching the cover to the module base assembly in step 6.

6. Attach the cover (key 43) to the module base assembly.
7. For sliding-stem applications only, install the protective shield onto the side of the replacement module base assembly (refer to figure 6-1).

Submodule Maintenance

The base unit's module base contains the following submodules: I/P converter, PWB assembly, and pneumatic relay. If problems occur, these submodules may be removed from the module base and replaced with new submodules. After replacing a submodule, the module base may be put back into service.

CAUTION

Exercise care when performing maintenance on the module base. Reinstall the cover to protect the I/P converter and gauges when servicing other submodules.

In order to maintain accuracy specifications, do not strike or drop the I/P converter during submodule maintenance.

I/P Converter

Refer to figure 7-2 for key number locations. The I/P converter (key 41) is located on the front of the module base.

Note

After I/P converter submodule replacement, calibrate the digital valve controller to maintain accuracy specifications.

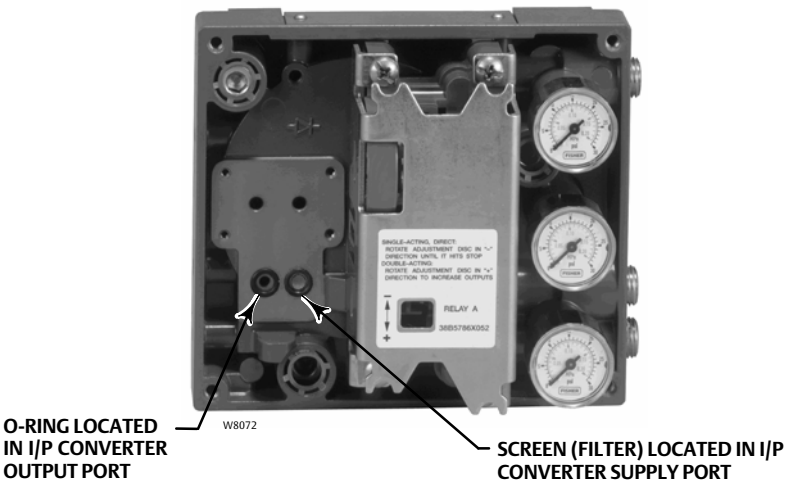
Replacing the I/P Filter

A screen in the supply port beneath the I/P converter serves as a secondary filter for the supply medium. To replace this filter, perform the following procedure:

1. Remove the I/P converter (key 41) and shroud (key 169) as described in the Removing the I/P Converter procedure.
2. Remove the screen (key 231) from the supply port.

3. Install a new screen in the supply port as shown in figure 6-3.
4. Inspect the O-ring (key 39) in the I/P output port; if necessary, replace it.
5. Reinstall the I/P converter (key 41) and shroud (key 169) as described in the Replacing the I/P Converter procedure.

Figure 6-3. I/P Filter Location



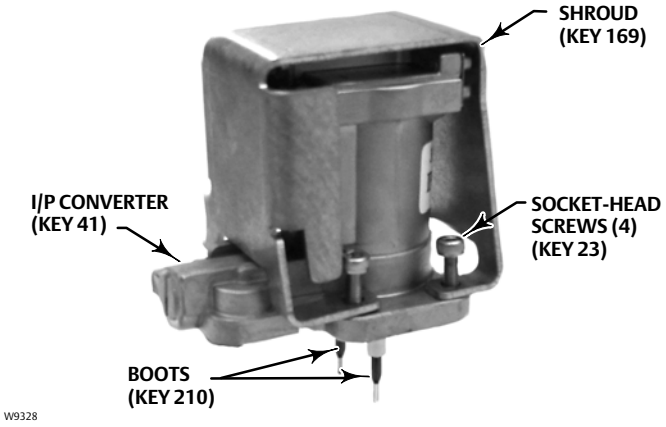
Removing the I/P Converter

1. Remove the front cover (key 43), if not already removed.
2. Refer to figure 6-4. Using a 2.5 mm hex socket wrench, remove the four socket-head screws (key 23) that attach the shroud (key 169) and I/P converter (key 41) to the module base (key 2).
3. Remove the shroud (key 169); then pull the I/P converter (key 41) straight out of the module base (key 2). Be careful not to damage the two electrical leads that come out of the base of the I/P converter.
4. Ensure that the O-ring (key 39) and screen (key 231) stay in the module base and do not come out with the I/P converter (key 41).

Replacing the I/P Converter

1. Refer to figure 6-3. Inspect the condition of the O-ring (key 39) and screen (key 231) in the module base (key 2). Replace them, if necessary. Apply silicone lubricant to the O-rings.
2. Ensure the two boots (key 210) shown in figure 6-4 are properly installed on the electrical leads.
3. Install the I/P converter (key 41) straight into the module base (key 2), taking care that the two electrical leads feed into the guides in the module base. These guides route the leads to the printed wiring board assembly submodule.
4. Install the shroud (key 169) over the I/P converter (key 41).
5. Install the four socket-head screws (key 23) and evenly tighten them in a crisscross pattern to a final torque of 1.6 N•m (14 lbf•in).
6. After replacing the I/P converter, calibrate travel or perform touch-up calibration to maintain accuracy specifications.

Figure 6-4. I/P Converter



PWB (Printed Wiring Board) Assembly

Refer to figure 7-2 for key number locations. The PWB assembly (key 50) is located on the back of the module base assembly (key 2).

Note

If the PWB assembly submodule is replaced, calibrate and configure the digital valve controller to maintain accuracy specifications.

Removing the Printed Wiring Board Assembly

1. Separate the module base from the housing by performing the Removing the Module Base procedure.
2. Remove three screws (key 33).
3. Lift the PWB assembly (key 50) straight out of the module base (key 2).
4. Ensure that the O-rings (key 40) remain in the pressure sensor bosses on the module base assembly (key 2) after the PWB assembly (key 50) has been removed.

Replacing the PWB Assembly and Setting the DIP Switch

1. Apply silicone lubricant to the pressure sensor O-rings (key 40) and install them on the pressure sensor bosses in the module base assembly.
2. Properly orient the PWB assembly (key 50) as you install it into the module base. The two electrical leads from the I/P converter (key 41) must guide into their receptacles in the PWB assembly and the pressure sensor bosses on the module base must fit into their receptacles in the PWB assembly.
3. Push the PWB assembly (key 50) into its cavity in the module base.
4. Install and tighten three screws (key 33) to a torque of 1 N•m (10.1 lbf•in).

5. Set the DIP switch on the PWB assembly according to table 6-2. On units that have the optional 4-20 mA position transmitter or switch hardware installed, set the Transmitter or Switch option according to table 6-3.

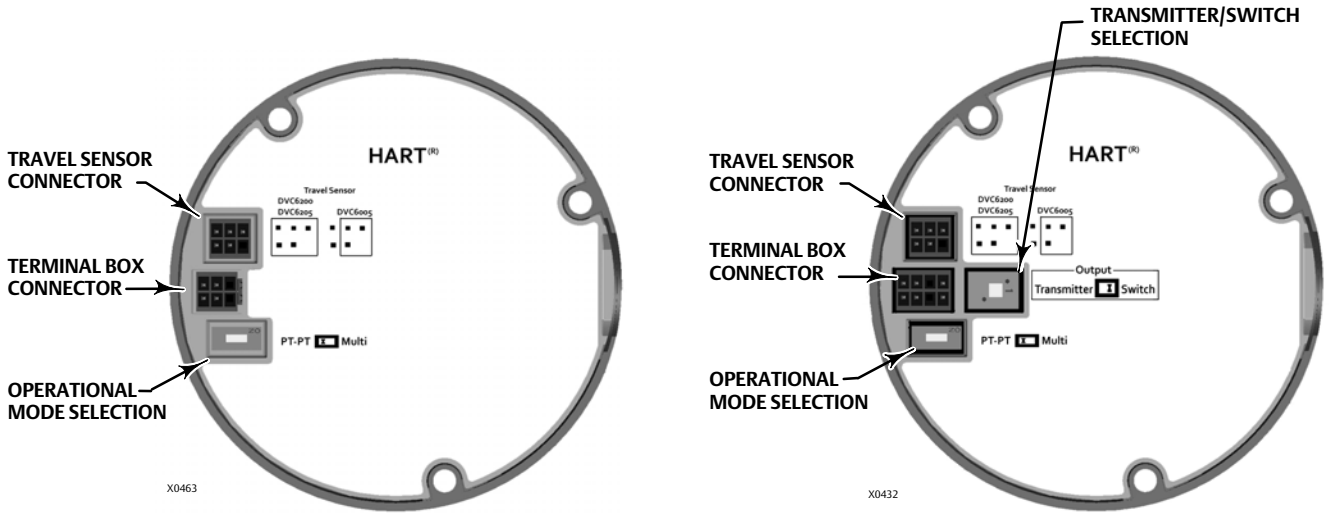
Table 6-2. DIP Switch Configuration(1)

Switch Label	Operational Mode	DIP Switch Position
PT-PT	4-20 mA Point-to-Point Loop	LEFT
Multi	24 VDC Multi-Drop Loop	RIGHT
1. Refer to figure 6-5 for switch location.		

Table 6-3. Output Switch Configuration(1)

Switch Label/Function	DIP Switch Position
Transmitter	LEFT
Switch	RIGHT
1. Refer to figure 6-5 for switch location.	

Figure 6-5. Printed Wiring Board (PWB) Connections and Settings



Note

For the digital valve controller to operate with a 4 to 20 mA control signal, be sure the DIP switch is in the point-to-point loop position.

6. Reassemble the module base to the housing by performing the Replacing the Module Base procedure.
7. Setup and calibrate the DVC6005 HW2 base unit.

Pneumatic Relay

Refer to figure 7-2 for key number locations. The pneumatic relay (key 24) is located on the front of the module base.

Note

After relay submodule replacement, calibrate the digital valve controller to maintain accuracy specifications.

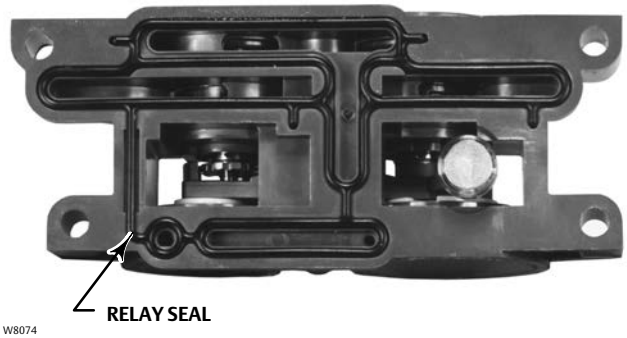
Removing the Pneumatic Relay

1. Loosen the four screws that attach the relay (key 24) to the module base. These screws are captive in the relay.
2. Remove the relay.

Replacing the Pneumatic Relay

1. Visually inspect the holes in the module base to ensure they are clean and free of obstructions. If cleaning is necessary, do not enlarge the holes.
2. Apply silicone lubricant to the relay seal and position it in the grooves on the bottom of the relay as shown in figure 6-6. Press small seal retaining tabs into retaining slots to hold relay seal in place.
3. Position the relay (with shroud) on the module base. Tighten the four screws, in a crisscross pattern, to a final torque of 2 N•m (20.7 lbf•in).
4. Using the Field Communicator, verify that the value for the parameter Relay matches the relay type installed.
5. After replacing the relay and verifying the relay type, calibrate travel or perform touch-up calibration to maintain accuracy specifications

Figure 6-6. Pneumatic Relay Assembly



Gauges, Pipe Plugs, or Tire Valves

Depending on the options ordered, the DVC6000 HW2 will be equipped with either gauges (key 47), pipe plugs (key 66), or tire valves (key 67). Single-acting direct instruments will also have a screen (key 236, figure 7-3). These are located on the top of the module base next to the relay.

Perform the following procedure to replace the gauges, tire valves, or pipe plugs. Refer to figure 7-2 for key number locations.

1. Remove the front cover (key 43).
2. Remove the gauge, pipe plug, or tire valve as follows:

For gauges (key 47), the flats are on the gauge case. Use a wrench on the flats of the gauge to remove the gauge from the module base. For double-acting instruments, to remove the supply gauge remove one of the output gauges.

For pipe plugs (key 66) and tire valves (key 67), use a wrench to remove these from the module base.

3. Apply pipe thread sealant (key 64) to the threads of the replacement gauges, pipe plugs, or tire valves.
4. Using a wrench, screw the gauges, pipe plugs, or tire valves into the module base.

Terminal Box

⚠ WARNING

Refer to the Maintenance WARNING at the beginning of this section.

Refer to figure 7-2 for key number locations.

The terminal box is located on the housing and contains the terminal strip assembly for field wiring connections.

Removing the Terminal Box

⚠ WARNING

To avoid personal injury or property damage caused by fire or explosion, remove power to the instrument before removing the terminal box cover in an area which contains a potentially explosive atmosphere or has been classified as hazardous.

1. Loosen the set screw (key 58) in the cap (key 4) so that the cap can be unscrewed from the terminal box.
2. After removing the cap (key 4), note the location of field wiring connections and disconnect the field wiring from the terminal box.
3. Separate the module base from the housing by performing the Removing the Module Base procedure.
4. Remove the screw (key 72). Pull the terminal box assembly straight out of the housing.
5. Remove two wire retainers (key 44), internal and external to the terminal box.

Replacing the Terminal Box

Note

Inspect all O-rings for wear and replace as necessary.

1. Install two wire retainers (key 44), internal and external to the terminal box.
2. Apply silicone lubricant to the O-ring (key 34) and install the O-ring over the stem of the terminal box.
3. Insert the terminal box assembly stem into the housing until it bottoms out. Position the terminal box assembly so that the hole for the screw (key 72) in the terminal box aligns with the threaded hole in the housing. Install the screw (key 72).
4. Connect the terminal box connector to the PWB assembly (key 50). Orientation of the connector is required.
5. Reassemble the module base to the housing by performing the Replacing the Module Base procedure.
6. Reconnect the field wiring as noted in step 2 in the Removing the Terminal Box procedure.
7. Apply silicone lubricant to the O-ring (key 36) and install the O-ring over the 2-5/8 inch threads of the terminal box. Use of a tool is recommended to prevent cutting the O-ring while installing it over the threads.
8. Apply lubricant (key 63) to the 2-5/8 inch threads on the terminal box to prevent seizing or galling when the cap is installed.
9. Screw the cap (key 4) onto the terminal box.
10. Install a set screw (key 58) into the cap (key 4). Loosen the cap (not more than 1 turn) to align the set screw over one of the recesses in the terminal box. Tighten the set screw (key 58).
11. Apply sealant (key 64) to the conduit entrance plug (key 62) and install it into the unused conduit entry of the terminal box.

Travel Sensor

⚠ WARNING

Refer to the Maintenance WARNING at the beginning of this section.

Replacing the travel sensor requires removing the remote feedback unit from the actuator.

⚠ WARNING

To avoid personal injury or property damage caused by fire or explosion, remove power to the instrument before removing the travel sensor assembly in an area which contains a potentially explosive atmosphere or has been classified as hazardous.

Disassembly

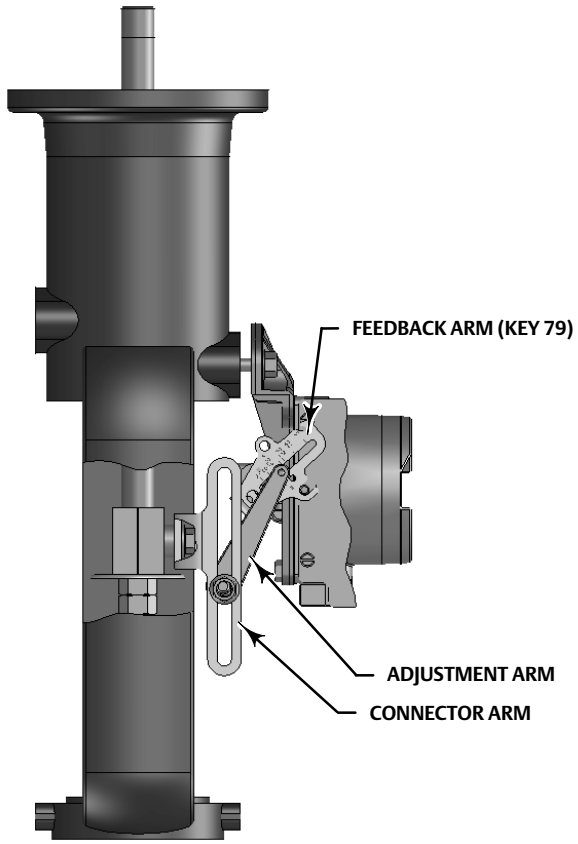
Note
If the feedback arm (key 79) or feedback arm assembly (key 84) is removed from the digital valve controller, the travel sensor assembly [i.e. potentiometer/bushing assembly (key 223)] must be recalibrated.

DVC6015 Remote Feedback Unit

Refer to figure 7-4 for key number locations.

1. Remove piping and fittings from the instrument.
2. Disconnect the adjustment arm from the connector arm and the feedback arm, see figure 6-7.
3. Remove the instrument from the actuator.
4. Loosen the screw (key 80) that secures the feedback arm (key 79) to the travel sensor shaft.
5. Remove the feedback arm (key 79) from the travel sensor shaft.
6. Disconnect the three travel sensor assembly wires from the terminals.
7. Remove the screw (key 72) that fastens the travel sensor assembly to the housing.
8. Pull the travel sensor assembly (key 223) straight out of the housing.

Figure 6-7. FIELDVUE DVC6015 Adjustment Arm



DVC6025 Remote Feedback Unit

Refer to figure 7-5 for key number locations.

1. Remove piping and fittings from the instrument.
2. Remove the instrument from the actuator.
3. Disconnect the bias spring (key 82) from the feedback arm assembly (key 84) and the arm assembly (key 91). Remove the mounting bracket (key 74) from the back of the digital controller. If the torsion spring (key 93) needs to be replaced, ensure that the shaft on which it is installed is smooth and free of rough spots. Replace the entire feedback arm assembly if necessary.
4. Loosen the screw (key 80) that secures the arm assembly to the travel sensor assembly shaft.
5. Remove the arm assembly (key 91) from the travel sensor assembly shaft.
6. Disconnect the three travel assembly wires from the terminals.
7. Remove the screw (key 72) that fastens the travel sensor assembly to the housing.
8. Pull the travel sensor assembly (key 223) straight out of the housing.

DVC6035 Remote Feedback Unit

Refer to figure 7-6 for key number locations.

1. Remove piping and fittings from the instrument.
2. Remove the instrument from the actuator. Loosen the screw (key 80) that secures the feedback arm (key 79) to the travel sensor shaft. Remove the feedback arm from the travel sensor assembly shaft.
3. Disconnect the three travel sensor assembly wires from the terminals.
4. From within the housing, unscrew the travel sensor assembly (key 223) from the housing.

Assembly

Note

If the feedback arm (key 79) or feedback arm assembly (key 84) is removed from the digital valve controller, the travel sensor assembly must be recalibrated.

DVC6015 Remote Feedback Unit

Refer to figure 7-4 for key number locations.

1. Insert the travel sensor assembly (key 223) into the housing (key 1). Secure the assembly with screw (key 72).
2. Connect the travel sensor assembly wires to the terminals as follows:
   red → terminal 1
   white → terminal 2
   black → terminal 3
3. Loosely assemble the bias spring (key 78), screw (key 80), plain washer (key 163), and nut (key 81) to the feedback arm (key 79), if not already installed.
4. Attach the feedback arm (key 79) to the travel sensor assembly shaft.

5. Using a Field Communicator, perform the appropriate Travel Sensor Adjust procedure in the Calibration section. Install the remote feedback unit on the actuator when the travel sensor adjustment is complete.

Note

If a Field Communicator is not available, perform the Travel Sensor Adjustment with Multimeter procedure below.

Travel Sensor Adjustment with a Multimeter (DVC6015)

1. Align the feedback arm (key 79) to the housing (key 1) by inserting the alignment pin (key 46) through the hole marked "A" on the feedback arm. Fully engage the alignment pin into the tapped hole in the side of the housing. Position the feedback arm so that the surface is flush with the end of the travel sensor shaft.
2. Connect a multimeter set to a resistance range of 50,000 ohms. Measure the resistance between terminals 1 and 3 of the remote feedback unit. Refer to figure 6-8 for terminal location. The resistance should be between 40,000 and 50,000 ohms.
3. Multiply the result in step 2 by 0.046 to get a calculated resistance. The calculated resistance should be in the range of 1840 to 2300 ohms.
4. Re-range the multimeter to a resistance of 3000 ohms between terminals 2 and 3 of the remote feedback unit. Refer to figure 6-8 for terminal location.
5. Adjust the travel sensor shaft to obtain the calculated resistance determined in step 3, ± 100 ohms.

Note

In the next step, be sure the feedback arm surface remains flush with the end of the travel sensor shaft.

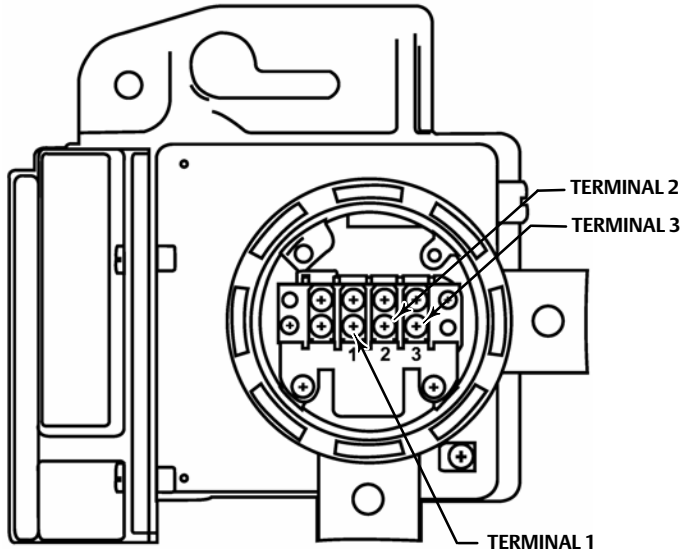
6. While observing the resistance, tighten the screw (key 80) to secure the feedback arm to the travel sensor shaft. Be sure the resistance reading remains at the calculated resistance determined in step 3, ± 100 ohms. Paint the screw to discourage tampering with the connection.
7. Disconnect the multimeter from the travel sensor connector.
8. Travel sensor adjustment is complete. Install the remote feedback unit on the actuator.

DVC6025 Feedback Unit

Refer to figure 7-5 for DVC6025 key number locations.

1. Insert the travel sensor assembly (key 223) into the housing. Secure the assembly with screw (key 72).
2. Connect the travel sensor assembly wires to the terminals as follows:
   red → terminal 1
   white → terminal 2
   black → terminal 3
3. Loosely assemble the screw (key 80), plain washer (key 163), and nut (key 81) to the arm assembly (key 91), if not already installed.
4. Attach the arm assembly (key 91) to the travel sensor assembly (key 223) shaft.

Figure 6-8. Remote Feedback Terminals; Potentiometer Resistance Measurement



5. Using a Field Communicator, perform the appropriate Travel Sensor Adjust procedure in the Calibration section. Install the remote feedback unit on the actuator when travel sensor adjustment is complete.

Note
If a Field Communicator is not available, perform the Travel Sensor Adjustment with Multimeter procedure below.

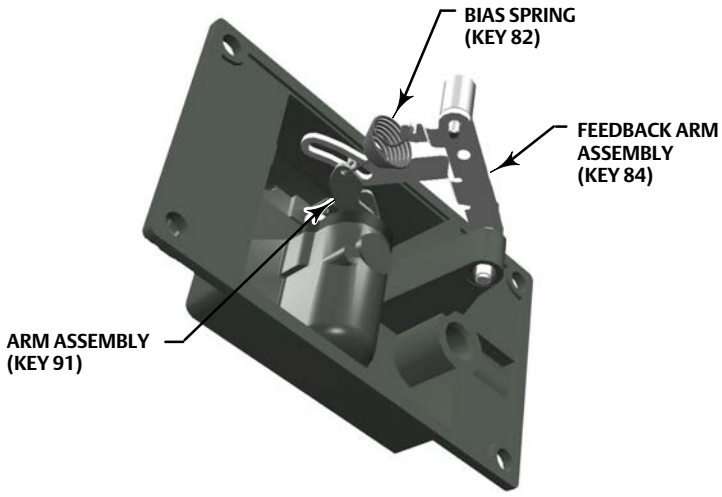
Travel Sensor Adjustment with a Multimeter (DVC6025)

1. Connect a multimeter set to a resistance range of 50,000 ohms. Measure the resistance between terminals 1 and 3 of the remote feedback unit. Refer to figure 6-8 for terminal location. The resistance should be between 40,000 and 50,000 ohms.
2. Multiply the result in step 1 by 0.142 to get a calculated resistance. The calculated resistance should be in the range of 5680 to 7100 ohms.
3. Re-range the multimeter to a resistance of 7000 ohms between terminals 2 and 3 of the remote feedback unit. Refer to figure 6-8 for terminal location.
4. Hold the arm assembly (key 91) in a fixed position so that the arm is parallel to the housing back plane and pointing toward the terminal box. Position the arm assembly so that the outer surface is flush with the end of the travel sensor shaft.
5. Adjust the travel sensor shaft to obtain the calculated resistance determined in step 2, ± 100 ohms.

Note
In the next step, be sure the arm assembly outer surface remains flush with the end of the travel sensor shaft.

6. While observing the resistance, tighten the screw (key 80) to secure the feedback arm to the travel sensor shaft. Be sure the resistance reading remains at the calculated resistance determined in step 2, ± 100 ohms. Paint the screw to discourage tampering with the connection.
7. Disconnect the multimeter from the travel sensor connector.
8. Apply anti-seize (key 64) to the pin portion of the arm assembly (key 91).
9. Position the mounting bracket over the back of the digital valve controller. Push the feedback arm assembly (key 84) toward the housing and engage the pin of the arm assembly into the slot in the feedback arm.
10. Install the mounting bracket (key 74).
11. Install the bias spring (key 82) as shown in figure 6-9.
12. Travel sensor adjustment is complete. Install the remote feedback unit on the actuator.

Figure 6-9. FIELDVUE DVC6025 digital Valve Controller, Bias Spring (key 82) Installation



NOTE:
INSTALL BIAS SPRING WITH SMALLER DIAMETER HOOK CONNECTED TO ARM ASSEMBLY (KEY 91)
AND WITH BOTH HOOK OPENINGS TOWARD CENTER OF BRACKET.

DVC6035 Remote Feedback Unit

Refer to figure 7-6 for DVC6035 key number locations.

1. Apply lubricant (key 63) to the travel sensor assembly threads.
2. Screw the travel sensor assembly (key 223) into the housing until it is tight.
3. Connect the travel sensor wires to the terminals as follows:
   red → terminal 1
   white → terminal 2
   black → terminal 3

4. Loosely assemble the bias spring (key 78), screw (key 80), plain washer (key 163), and nut (key 81) to the feedback arm (key 79), if not already installed.
5. Attach the feedback arm (key 79) to the travel sensor shaft.
6. Using a Field Communicator, perform the appropriate Travel Sensor Adjust procedure in the Calibration section. Install the remote feedback unit on the actuator when travel sensor adjustment is complete.

Note

If a Field Communicator is not available, perform the Travel Sensor Adjustment with a Multimeter procedure below.

Travel Sensor Adjustment with a Multimeter (DVC6035)

1. Align the feedback arm (key 79) to the housing (key 1) by inserting the alignment pin (key 46) through the hole marked “A” on the feedback arm. Fully engage the alignment pin into the tapped hole in the housing. Position the feedback arm so that the outer surface is flush with the end of the travel sensor shaft.
2. Connect a multimeter set to a resistance range of 50,000 ohms. Measure the resistance between terminals 1 and 3 of the remote feedback unit. Refer to figure 6-8 for terminal location. The resistance should be between 40,000 and 50,000 ohms.
3. Multiply the result in step 2 by 0.042 to get a calculated resistance. The calculated resistance should be in the range of 1680 to 2100 ohms.
4. Re-range the multimeter to a resistance of 3000 ohms between terminals 2 and 3 of the remote feedback unit. Refer to figure 6-8 for terminal location.
5. Adjust the travel sensor shaft to obtain the calculated resistance determined in step 3, ± 100 ohms.

Note

In the next step, be sure the feedback arm outer surface remains flush with the end of the travel sensor shaft.

6. While observing the resistance, tighten the screw (key 80) to secure the feedback arm to the travel sensor shaft. Be sure the resistance reading remains at the calculated resistance determined in step 3, ± 100 ohms. Paint the screw to discourage tampering with the connection.
7. Disconnect the multimeter from the travel sensor connector.
8. Travel sensor adjustment is complete. Install the remote feedback unit on the actuator as described in the Installation section.

Troubleshooting

If communication or output difficulties are experienced with the instrument, refer to the troubleshooting chart in table 6-4. Also see the DVC6000 HW2 Troubleshooting Checklist on page 83.

Checking Voltage Available

⚠ WARNING

Personal injury or property damage caused by fire or explosion may occur if this test is attempted in an area which contains a potentially explosive atmosphere or has been classified as hazardous.

To check the Voltage Available at the instrument, perform the following:

1. Connect the equipment in figure 2-3 to the field wiring in place of the FIELDVUE instrument.
2. Set the control system to provide maximum output current.
3. Set the resistance of the 1 kilohm potentiometer shown in figure 2-3 to zero.
4. Record the current shown on the milliammeter.
5. Adjust the resistance of the 1 kilohm potentiometer until the voltage read on the voltmeter is 10.0 volts.
6. Record the current shown on the milliammeter.
7. If the current recorded in step 6 is the same as that recorded in step 4 (± 0.08 mA), the voltage available is adequate.
8. If the voltage available is inadequate, refer to Section 2, Wiring Practices.

Restart Processor

This is a “soft” reset of the device. This procedure can only be performed while the instrument is out of service. A soft reset will immediately put into effect changes that have been sent to the instrument. Also, if the device is configured to shutdown on an alert, the soft reset will clear the shutdown.

Table 6-4. Instrument Troubleshooting

Symptom	Possible Cause	Action
1. Analog input reading at instrument does not match actual current provided.	1a. Control mode not Analog.	1a. Check the control mode using the Field Communicator. If in the Digital or Test mode, the instrument receives its set point as a digital signal. Control is not based on input current. Change Control Mode to Analog.
	1b. Low control system compliance voltage.	1b. Check system compliance voltage (see Wiring Practices in the Installation section.
	1c. Instrument shutdown due to self test failure.	1c. Check instrument status using the Field Communicator (see Viewing Instrument Status in the Viewing Device Information section).
	1d. Analog input sensor not calibrated.	1d. Calibrate the analog input sensor (see Analog Input Calibration in the Calibration section).
	1e. Current leakage.	1e. Excessive moisture in the terminal box can cause current leakage. Typically the current will vary randomly if this is the case. Allow the inside of the terminal box to dry, then retest.
2. Instrument will not communicate.	2a. Insufficient Voltage Available.	2a. Calculate Voltage Available (see Wiring Practices in the Installation section). Voltage Available should be greater than or equal to 10 VDC.
	2b. Controller output Impedance too low.	2b. Install a HART filter after reviewing Control System Compliance Voltage requirements (see Wiring Practices in the Installation section).
	2c. Cable capacitance too high.	2c. Review maximum cable capacitance limits (see Wiring Practices in the Installation section).
	2d. HART filter improperly adjusted.	2d. Check filter adjustment (see the appropriate HART filter instruction manual).
	2e. Improper field wiring.	2e. Check polarity of wiring and integrity of connections. Make sure cable shield is grounded only at the control system.
	2f. Controller output providing less than 4 mA to loop.	2f. Check control system minimum output setting, which should not be less than 3.8 mA.
	2g. Disconnected loop wiring cable at PWB.	2g. Verify connectors are plugged in correctly.
	2h. PWB DIP switch not set properly.	2h. Check for incorrect setting or broken DIP switch on the back of the PWB. Reset switch or replace PWB, if switch is broken. See table 6-2 for switch setting information
	2j. PWB failure.	2j. Use a 4-20 mA current source to apply power to the instrument. Terminal voltage across the LOOP+ and LOOP- terminals should be 8 to 9.5 VDC. If the terminal voltage is not 8 to 9.5 VDC, replace the PWB.
	2k. Polling address incorrect.	2k. Use the Field Communicator to set the polling address (refer to the Detailed Setup section). From the *Utility* menu, select *Configure Communicator* and *Polling*. Select *Always Poll*. Set the instrument polling address to 0.
	2l. Defective terminal box.	2l. Check continuity from each screw terminal to the corresponding PWB connector pin. If necessary, replace the terminal box assembly.
	2m. Defective Field Communicator or ValveLink modem cable.	2m. If necessary, repair or replace cable.
	2n. ValveLink modem defective or not compatible with PC.	2n. Replace ValveLink modem.
	2p. ValveLink hardlock defective or not programmed.	2p. Replace if defective or return to factory for programming.
3. Instrument will not calibrate, has sluggish performance or oscillates.	3a. Travel sensor seized, will not turn.	3a. Rotate feedback arm to ensure it moves freely. If not, replace the travel sensor (pot/bushing) assembly.
	3b. Broken travel sensor wire(s).	3b. Inspect wires for broken solder joint at potentiometer or broken wire. Replace travel sensor (pot/bushing) assembly.
	3c. Travel sensor misadjusted.	3c. Perform Travel Sensor Adjust procedure in the Calibration section.
	3d. Open travel sensor.	3d. Check for continuity in electrical travel range. If necessary, replace pot/bushing assembly.
	3e. Cables not plugged into PWB correctly.	3e. Inspect connections and correct.
	3f. Feedback arm loose on potentiometer.	3f. Perform Travel Sensor Adjust procedure in the Calibration section.

Table 6-4. Instrument Troubleshooting (Continued)

Symptom	Possible Cause	Action
3. Instrument will not calibrate, has sluggish performance or oscillates.	3g. Feedback arm bent/damaged or bias spring missing/damaged.	3g. Replace feedback arm and bias spring.
	3h. Configuration errors.	3h. Verify configuration: If necessary, set protection to None. If Out of Service, place In Service. Check: Travel Sensor Motion Tuning set Zero control signal Feedback Connection Control mode (should be Analog) Restart control mode (should be Analog)
	3j. Restricted pneumatic passages in I/P converter.	3j. Check screen in I/P converter supply port of the module base. Replace if necessary. If passages in I/P converter restricted, replace I/P converter.
	3k. O-ring(s) between I/P converter ass'y missing or hard and flattened losing seal.	3k. Replace O-ring(s).
	3l. I/P converter ass'y damaged/corroded/clogged.	3l. Check for bent flapper, open coil (continuity), contamination, staining, or dirty air supply. Coil resistance should be between 1680 - 1860 ohms. Replace I/P assembly if damaged, corroded, clogged, or open coil.
	3m. I/P converter ass'y out of spec.	3m. I/P converter assembly nozzle may have been adjusted. Verify drive signal (55 to 80% for double-acting; 60 to 85% for single-acting) with the valve off the stops. Replace I/P converter ass'y if drive signal is continuously high or low.
	3n. Defective module base seal.	3n. Check module base seal for condition and position. If necessary, replace seal.
	3p. Defective relay.	3p. Depress relay beam at adjustment location in shroud, look for increase in output pressure. Remove relay, inspect relay seal. Replace relay seal or relay if I/P converter ass'y good and air passages not blocked. Check relay adjustment.
	3q. Defective 67CFR regulator, supply pressure gauge jumps around.	3q. Replace 67CFR regulator.
4. ValveLink diagnostic tests provide erroneous results.	4a. Bent or defective pressure sensor.	4a. Replace PWB.
	4b. Pressure sensor O-ring missing.	4b. Replace O-ring.
5. Field Communicator does not turn on.	5a. Battery pack not charged.	5a. Charge battery pack. Note: Battery pack can be charged while attached to the Field communicator or separately. The Field Communicator is fully operable while the battery pack is charging. Do not attempt to charge the battery pack in a hazardous area.

DVC6000 HW2 Troubleshooting Checklist

1. Instrument serial number as read from nameplate _____
2. Is the digital valve controller responding to the control signal? Yes _____ No _____

   If not, describe _____
3. Measure the voltage across the “Loop -” and Loop +” terminal box screws when the commanded current is 4.0 mA and 20.0 mA: _____V @ 4.0 mA _____V @ 20.0 mA.
   (These values should be around 8.6 V @ 4.0 mA and 8.8 V @ 20 mA.)
4. Is it possible to communicate via HART to the digital valve controller? Yes _____ No _____
5. What is the Diagnostic Tier of the digital valve controller? AC ____ HC ____ AD ____ PD ____ ODV____
6. What is the firmware version of the digital valve controller? _____
7. What is the hardware version of the digital valve controller? _____
8. Is the digital valve controller's Instrument Mode “In Service”? Yes _____ No _____
9. Is the digital valve controller's Control Mode set to “Analog”? Yes _____ No _____
10. Is it on Travel or Pressure control?
11. What are the following parameter readings?

    Input Signal _____ Drive Signal _____%

    Supply Pressure _____ Pressure A _____ Pressure B _____

    Travel Target _____% Travel _____%
12. What are the following alert readings?

    Fail alerts _____

    Valve alerts _____

    Operational status _____

    Alert event record entries _____
13. Export ValveLink data (if available) for the device (Status Monitor, Detailed Setup, etc.).

Mounting

1. Which DVC6000 HW2 do you have? DVC6005 HW2 w/ DVC6015 ____ DVC6025 ____ DVC6035 ____
2. What Make, Brand, Style, Size, etc. actuator is the DVC6000 HW2 mounted on? _____
3. What is the full travel of the valve? _____
4. What is the Mounting Kit part number? _____
5. If mounting kits are made by LBP/Customer, please provide pictures of installation.
6. Is the Mounting kit installed per the instructions? Yes _____ No _____
7. What is the safe position of the valve? Fail closed _____ Fail open _____

Section 7 Parts

Parts Ordering

Whenever corresponding with your Emerson Process Management sales office about this equipment, always mention the controller serial number.

⚠ WARNING

Use only genuine Fisher replacement parts. Components that are not supplied by Emerson Process Management should not, under any circumstances, be used in any Fisher instrument. Use of components not supplied by Emerson Process Management may void your warranty, might adversely affect the performance of the instrument, and could cause personal injury and property damage.

Parts Kits

Kit	Description	Part Number
1*	Elastomer Spare Parts Kit (kit contains parts to service one digital valve controller)	
	Standard	19B5402X012
	Extreme Temperature option (fluorosilicone elastomers)	19B5402X022
2*	Small Hardware Spare Parts Kit (kit contains parts to service one digital valve controller)	19B5403X012
3	Conversion Kit, DVC6015 to DVC6025	19B5405X012
4	Conversion Kit, DVC6025 to DVC6015	14B5072X112
5	Alignment Pin Kit [kit contains 15 alignment pins (key 46)]	14B5072X092
6*	Seal Screen Kit [kit contains 25 seal screens (key 231) and 25 O-rings (key 39)]	
	Standard and Extreme Temperature option (fluorosilicone elastomers)	14B5072X182

Kit	Description	Part Number

Note

The following terminal boxes are only compatible with PWB Assembly electronics hardware revision 2 (HW2) (key 50), as shown in figure 7-1. Use only with replace in-kind.

7	Terminal Box Kit	
	Without I/O Package	
	Standard Temperature (nitrile elastomers)	19B5401X142
	Extreme Temperature (fluorosilicone elastomers	19B5401X152
	Without I/O Package, Natural Gas Approved	
	Standard Temperature (nitrile elastomers)	19B5401X162
	Extreme Temperature (fluorosilicone elastomers	19B5401X172
	With I/O Package	
	Standard Temperature (nitrile elastomers)	19B5401X182
	Extreme Temperature (fluorosilicone elastomers)	19B5401X192

*Recommended spare

Kit	Description	Part Number
8*	I/P Converter Kit	
	Standard	38B6041X152
	For Extreme Temperature option (fluorosilicone elastomers)	38B6041X132
9	Adjustment Arm Kit (includes washer, nut and adjustment arm)	14B5072X132
10*	Spare Module Base Assembly Kit [kit contains module base (key 2); drive screws, qty. 2, (key 11); shield/label (key 19); hex socket cap screw, qty. 3, (key 38); self tapping screw, qty. 2 (key 49); pipe plug, qty. 3 (key 61); retaining ring, qty. 3 (key 154); screen (key 236); and flame arrestors, qty. 3 (key 243)]	GE18654X012
11*	Spare Shroud Kit	GE29183X012
12	Remote Travel Sensor Assembly	

Note

Contact your Emerson Process Management sales office for Remote Travel Sensor Assembly ordering information.

13	Remote Terminal Box Kit	GE00418X012
14	Feedback Unit	
	DVC6015	49B7986X012
	DVC6025 long arm	49B7987X012
	DVC6025 Short Arm	49B7987X022
	DVC6035	49B7988X012
	DVC6035 (for GX actuator)	49B7988X022
15	Feedback Unit Termination Strip Kit	GE00419X012
16	Pipestand/Wall Mounting Kit	GE00420X012

Parts List

Note

Contact your Emerson Process Management sales office for Part Ordering information.

Note

Parts with footnote numbers shown are available in parts kits; see footnote information at the bottom of the page.

Kit	Description	Part Number

DVC6005 HW2 Base Unit (see figure 7-2)

Housing

1	Housing
11	Drive Screw (2 req'd)
20	Shield
52	Vent, plastic(2)
74	Mounting Bracket(16)
248	Screw, hex head(16) (4 req'd)
249	Screw, hex head(16) (4 req'd)
250	Spacer(16) (4 req'd)
267	Standoff(16) (2 req'd)
271	Screen

Common Parts

16*	O-ring(1) (3 req'd)
29	Warning label, for use only with LCIE hazardous area classifications
33	Mach Screw, pan hd, SST(2) (3 req'd)
38	Cap Screw, hex socket, SST(2,10) (3 req'd)
43*	Cover Assembly (includes cover screws)
	Standard 38B9580X022
	Extreme temperature option (fluorosilicone elastomers) 38B9580X032
48	Nameplate
49	Screw, self tapping (2 req'd)(10)
63	Lithium grease (not furnished with the instrument)
64	Pipe thread sealant (not furnished with the instrument)
65	Lubricant, silicone sealant (not furnished with the instrument)
154	Retaining Ring(2) (3 req'd)
237	Module Base Seal(1)

Module Base

2	Module Base(10)
11	Drive Screw(10) (2 req'd)
12	O-ring(1)
19	Shield Assembly(10)
61	Pipe Plug, hex socket(10) (3 req'd)
236	Screen, for single-acting direct units only(10)
243	Flame Arrestor Assembly(10) (3 req'd)

I/P Converter Assembly

23	Cap Screw, hex socket, SST(2,11) (4 req'd)
39*	O-ring (1,8)
41	I/P Converter(8)
169	Shroud(8, 11)
210*	Boot, nitrile(1,8) (2 req'd) (also see figure 6-4)
231*	Seal Screen(1,6,8)

*Recommended spare

1. Available in the Elastomer Spare Parts Kit
2. Available in the Small Hardware Spare Parts Kit
6. Available in the Seal Screen Kit
8. Available in the I/P Converter Kit
10. Available in the Spare Module Base Assembly Kit
11. Available in the Spare Shroud Kit
16. Available in the Pipestand/Wall Mounting Kit

Key	Description	Part Number

Relay

24*	Relay Assembly, (includes shroud, relay seal, mounting screws)	
	Standard	
	Single-acting direct (relay C)	38B5786X132
	Double-acting (relay A)	38B5786X052
	Single-acting reverse (relay B)	38B5786X092
	Low Bleed	
	Single-acting direct (relay C)	38B5786X152
	Double-acting (relay A)	38B5786X072
	Single-acting reverse (relay B)	38B5786X112
	Extreme Temperature option (fluorosilicone elastomers)	
	Standard Bleed	
	Single-acting direct (relay C)	38B5786X142
	Double-acting (relay A)	38B5786X032
	Single-acting reverse (relay B)	38B5786X102
	Low Bleed	
	Single-acting direct (relay C)	38B5786X162
	Double-acting (relay A)	38B5786X082
	Single-acting reverse (relay B)	38B5786X122

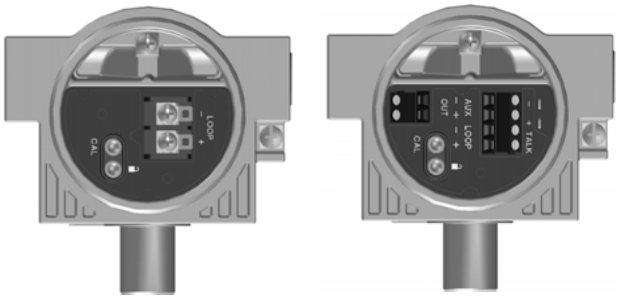
Terminal Box

4	Terminal Box Cap(13)
34*	O-ring(1,7,13)
36*	O-ring(1,7,13)
44	Wire Retainer, pl stl(2) (6 req'd) (not shown)
58	Set Screw, hex socket, SST(2,13)
72	Cap Screw, hex socket, SST(2,13)
164	Terminal Box Assembly(7)

Feedback Connections Terminal Box

4	Terminal Box Cap(13)
34*	O-ring(1,7,13)
36*	O-ring(1,7,13)
44	Wire Retainer, pl stl(2,14) (5 req'd) (not shown)
58	Set Screw, hex socket, SST(2,13)
62	Pipe Plug, hex hd, SST(13)
72	Cap Screw, hex socket, SST(2,13) (3 req'd)
262	Adapter(13)
263*	O-ring(13)
	Standard
	Extreme temperature option, (fluorosilicone)
264	Terminal Box Assembly, remote(13)

Figure 7-1. Terminal Box



WITHOUT I/O PACKAGE **WITH I/O PACKAGE**

Key	Description

PWB Assembly

50*	PWB Assembly for DVC6005 HW2

Note

The following PWB Assemblies are only compatible with the terminal boxes shown in figure 7-1.

Hardware Revision 2 (HW2), without I/O Package
- For instrument level HC
- For instrument level AD
- For instrument level PD
- For instrument level ODV

Hardware Revision 2 (HW2), with I/O Package
- For instrument level HC
- For instrument level AD
- For instrument level PD
- For instrument level ODV

*Recommended spare

1. Available in the Elastomer Spare Parts Kit
2. Available in the Small Hardware Spare Parts Kit
7. Available in the Terminal Box Kit
13. Available in the Remote Terminal Box Kit

Key	Description	Part Number

Pressure Gauges, Pipe Plugs, or Tire Valve Assemblies (see figure 7-3)

47*	Pressure Gauge, nickel-plated brass case, brass connection	
	Double-acting (3 req'd); Single-acting (2 req'd)	
	PSI/MPA Gauge Scale	
	To 60 PSI, 0.4 MPa	18B7713X042
	To 160 PSI, 1.1 MPa	18B7713X022
	PSI/bar Gauge Scale	
	To 60 PSI, 4 bar	18B7713X032
	To 160 PSI, 11 bar	18B7713X012
	PSI/KG/CM^2 Gauge Scale	
	To 60 PSI, 4 KG/CM^2	18B7713X072
	To 160 PSI, 11 KG/CM^2	18B7713X082
66	Pipe Plug, hex hd	
	For double-acting and single acting direct w/gauges (none req'd)	
	For single-acting reverse w/gauges (1 req'd)	
	For all units w/o gauges (3 req'd)	
67	Tire Valve Assembly (3 req'd)	
	Not for mounting on 1250 and 1250R actuators.	

Remote Feedback Units

Common Parts
DVC6015, DVC6025, and DVC6035 (see figures 7-4, 7-5, and 7-6)

23	Cap Screw, hex socket(14,15) (2 req'd)	
44	Wire Retainer, pl stl(14,15) (9 req'd)	
46	Alignment Pin(5,14)	
	for DVC6015 and DVC6035	
49	Screw, self tapping (2 req'd)	
58	Set Screw, hex socket(14)	
62	Pipe Plug, hex hd, SST(14)	
64	Anti-seize compound (not furnished with the instrument)	
65	Lubricant, silicone sealant (not furnished with the instrument)	
72	Cap Screw, hex socket(2,14) (2 req'd)	
	for DVC6015, and DVC6025	
78	Bias Spring, SST(2,14)	
	for DVC6015 and DVC6035	
79	Feedback Arm	
	for DVC6015 and DVC6035	
80	Cap Screw, hex socket, SST(2,14)	
81	Square Nut, SST(2,14)	
104	Cap Screw, hex hd(14) (4 req'd), DVC6015 only	
	Not for mounting on 1250 and 1250R actuators. Mounting parts for 1250 and 1250R actuators are included in the mounting kit for these actuators.	
107	Mounting Bracket(14), DVC6015 only	
	Not for mounting on 1250 and 1250R actuators. Mounting parts for 1250 and 1250R actuators are included in the mounting kit for these actuators.	
---	Feedback Linkage Shield	
	Up to 50.4 mm (2 inch) travel	
	All sliding-stem actuators except 585C size 60	
	50.4 mm (2 inch) to 104mm (4 inch) travel	
	All sliding-stem actuators except 585C size 60	
	585C size 60, 19 mm (0.75 inch) to 104 mm (4 inch) travel	
131	Retainer Wire	
163	Plain Washer, SST(2,14)	
223*	Potentiometer/Bushing Assembly (Travel Sensor Assembly)(14)	
	DVC6015 and DVC6025	
	DVC6035	
251	Feedback housing(14)	
252	Assembly Plate Shield(14) (DVC6015 only)	
253	Terminal bracket(14,15)	
254	Terminal Strip(14,15)	
255	Terminal Cap(14)	
256	O-ring, fluorosilicone(14)	
257	Machine Screw, pan head(14) (2 req'd) (DVC6015 only)	
258	Label, cover(14)	
260	Hex Nut, SST (2 req'd)	
261	Nameplate	
265	Plug(14) (DVC6015 and DVC6035 only)	

DVC6025 (see figure 7-5)

74	Mounting Bracket
82	Bias Spring, SST
83	Bearing Flange, PTFE-based (2 req'd)
84	Feedback Arm Assembly, SST
85	E-ring, pl stl (2 req'd)
86	Plain Washer, pl stl (2 req'd)
87	Follower Post, SST
88	Roller, SST/PTFE
89	Spring Lock Washer, pl stl
90	Hex Nut, pl stl
91	Arm Assembly, SST
92	Cap Screw, hex socket (4 req'd)
93	Torsion Spring, Feedback Arm

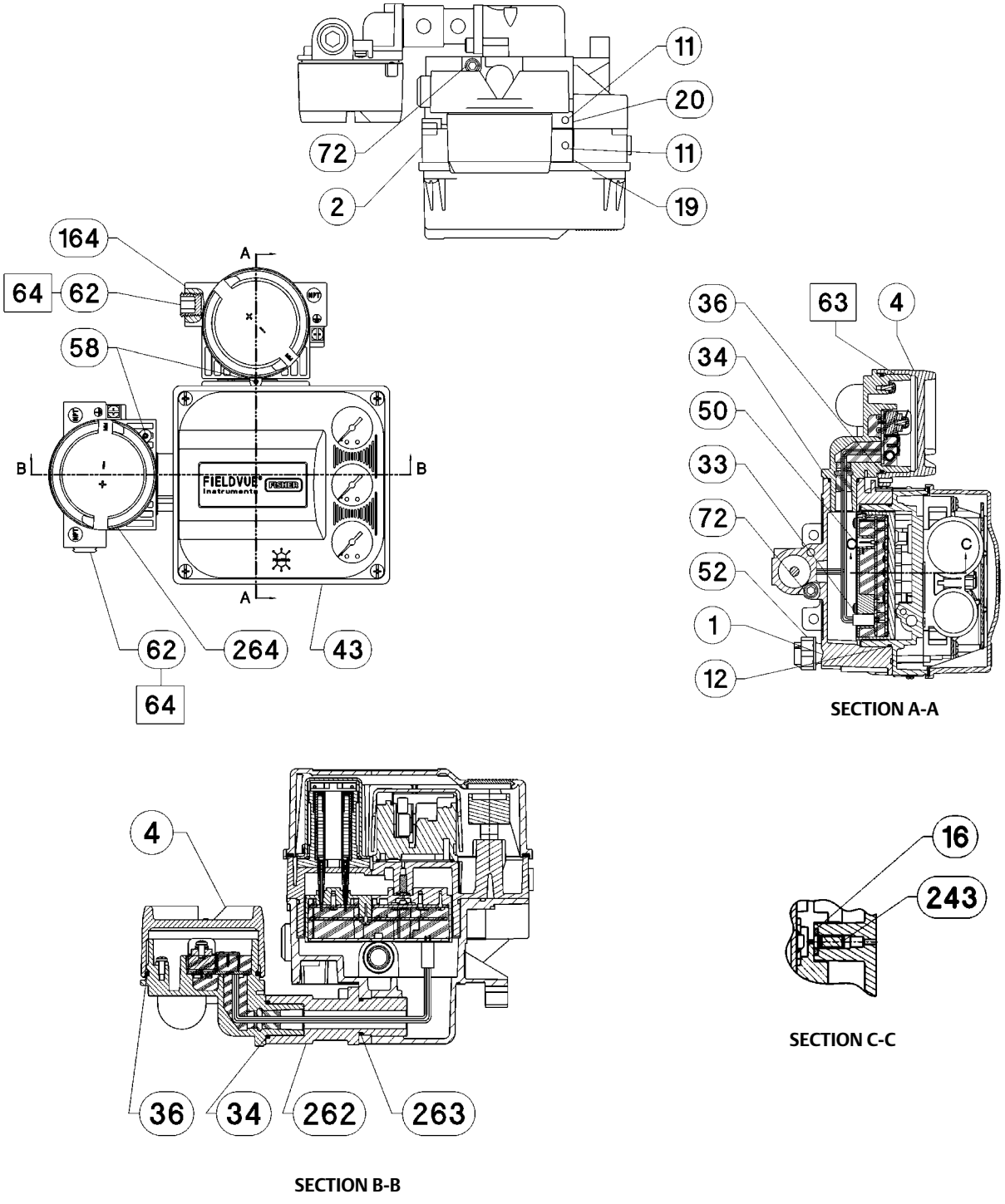
HART Filters

HF340, DIN rail mount	39B5411X022
HF341, DIN rail Mount, pass through (no filter)	39B5412X012

*Recommended spare

2. Available in the Small Hardware Spare Parts Kit
5. Available in Alignment Pin Kit
14. Available in Feedback Unit Kit
15. Available in Feedback Unit Termination Strip Kit

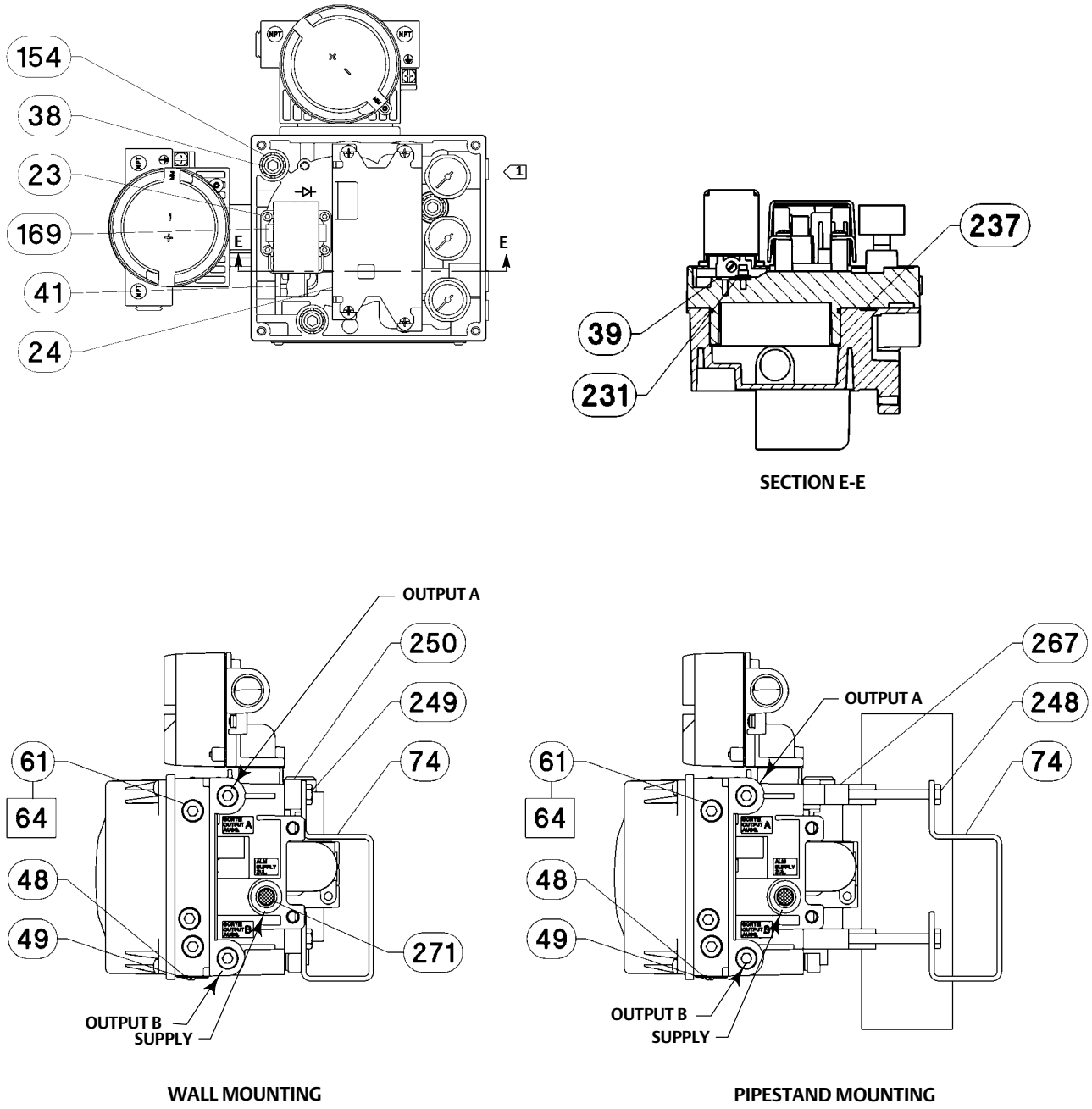
Figure 7-2. FIELDVUE DVC6005 HW2 Base Unit Assembly



☐ APPLY LUB, SEALANT
NOTES:
1. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

49B3261-C SHT 1 & 2

Figure 7-2. FIELDVUE DVC6005 HW2 Base Unit Assembly (continued)

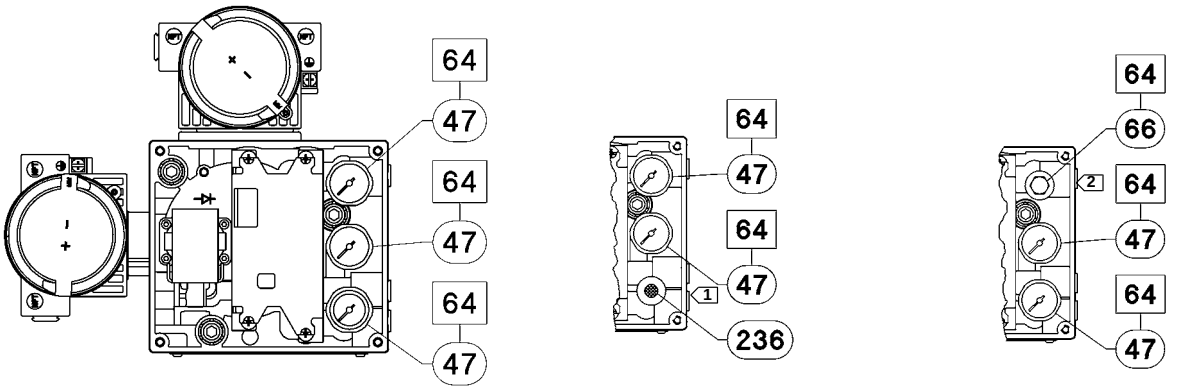


☐ APPLY LUB, SEALANT

NOTES:
1 SEE FIGURE 7-3 FOR GAUGE CONFIGURATIONS
2. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

49B3261-C SHT 2 & 3

Figure 7-3. Typical FIELDVUE DVC6005 HW2 Digital Valve Controller Gauge Configuration



DOUBLE-ACTING

SINGLE-ACTING DIRECT

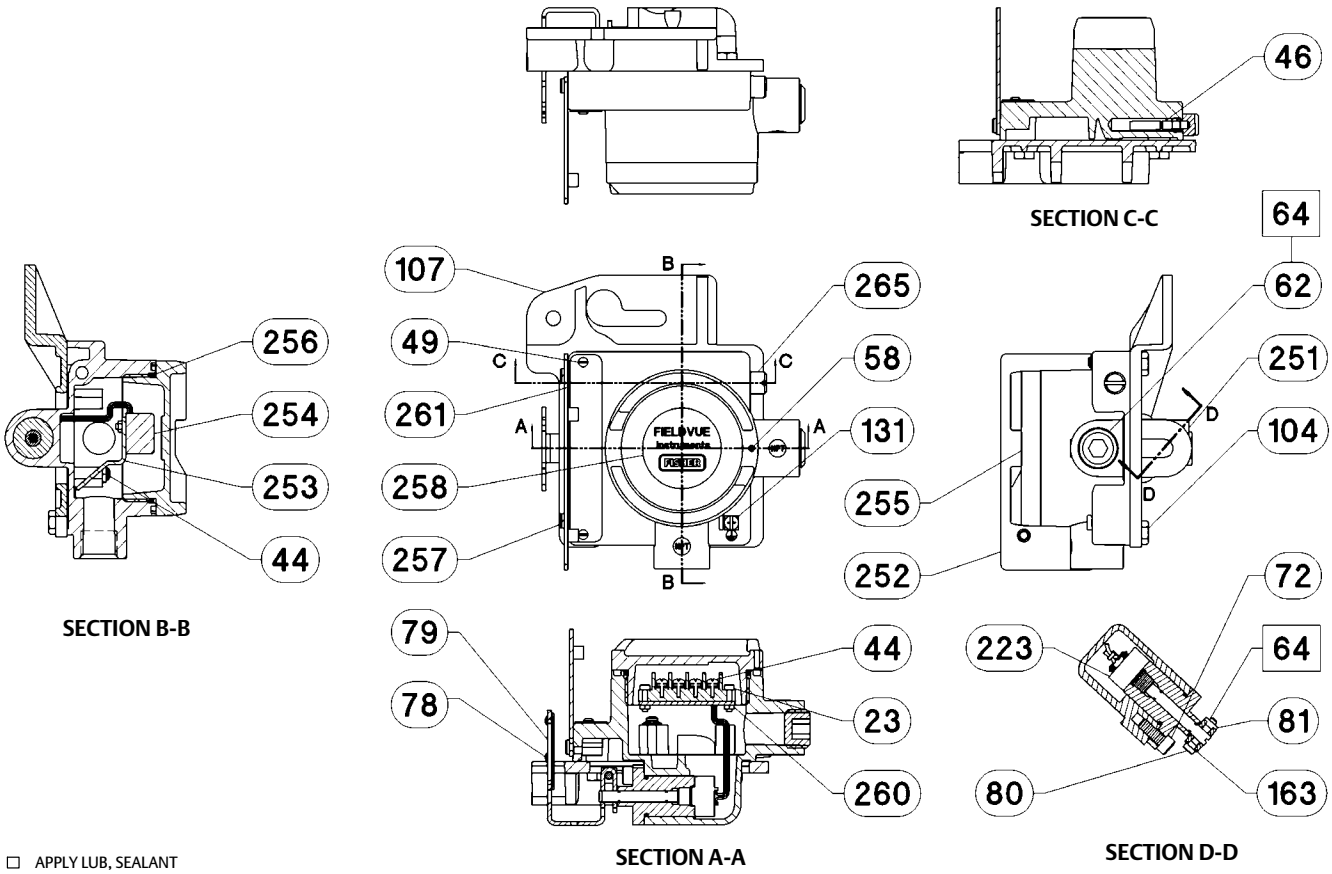
SINGLE-ACTING REVERSE

□ APPLY LUB, SEALANT

NOTE:
1 FOR SINGLE-ACTING DIRECT, OUTPUT B IS PLUGGED.
2 FOR SINGLE-ACTING REVERSE, OUTPUT A IS PLUGGED.

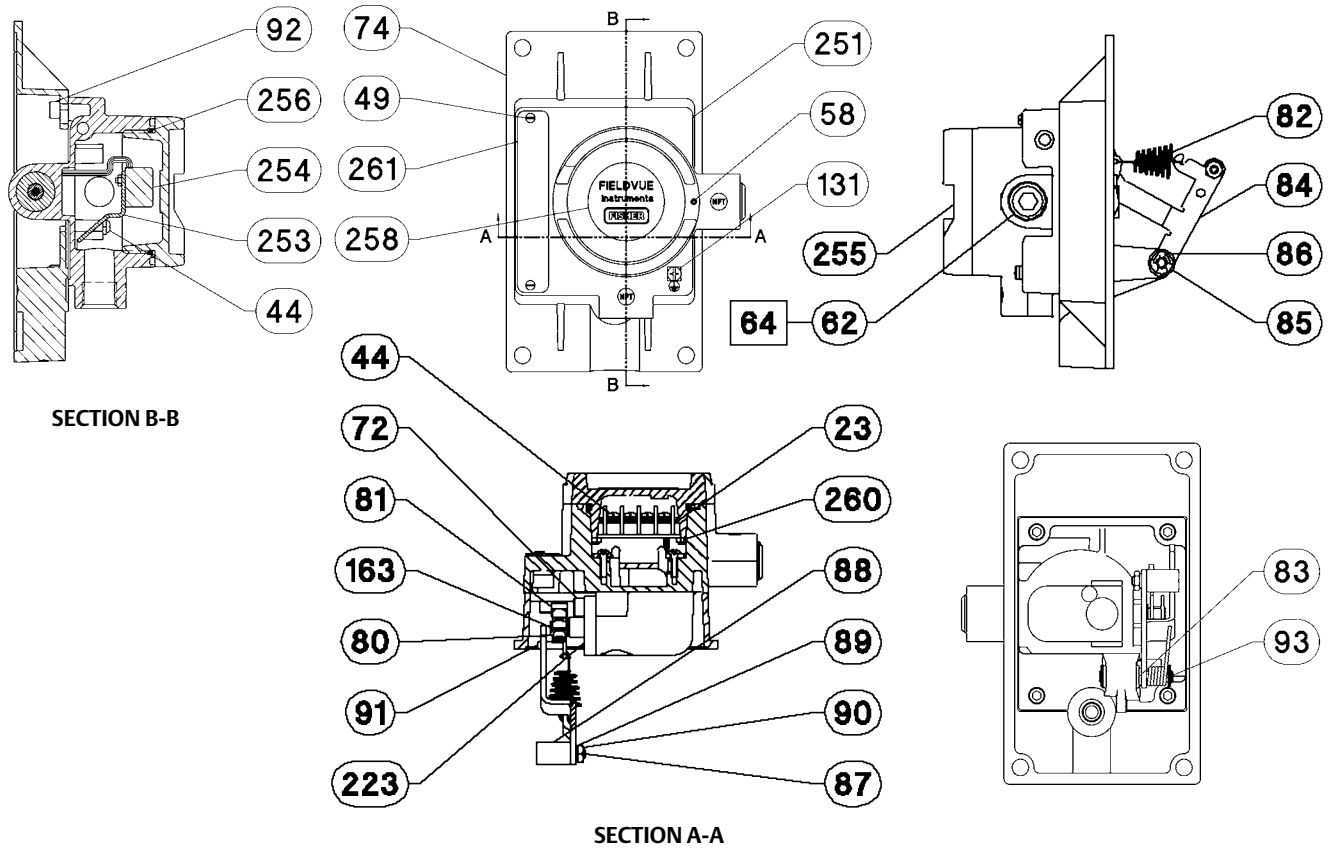
49B3261-C SHT 2

Figure 7-4. FIELDVUE DVC6015 Remote Feedback Unit Assembly



☐ APPLY LUB, SEALANT
NOTE:
1. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED
49B7986-A

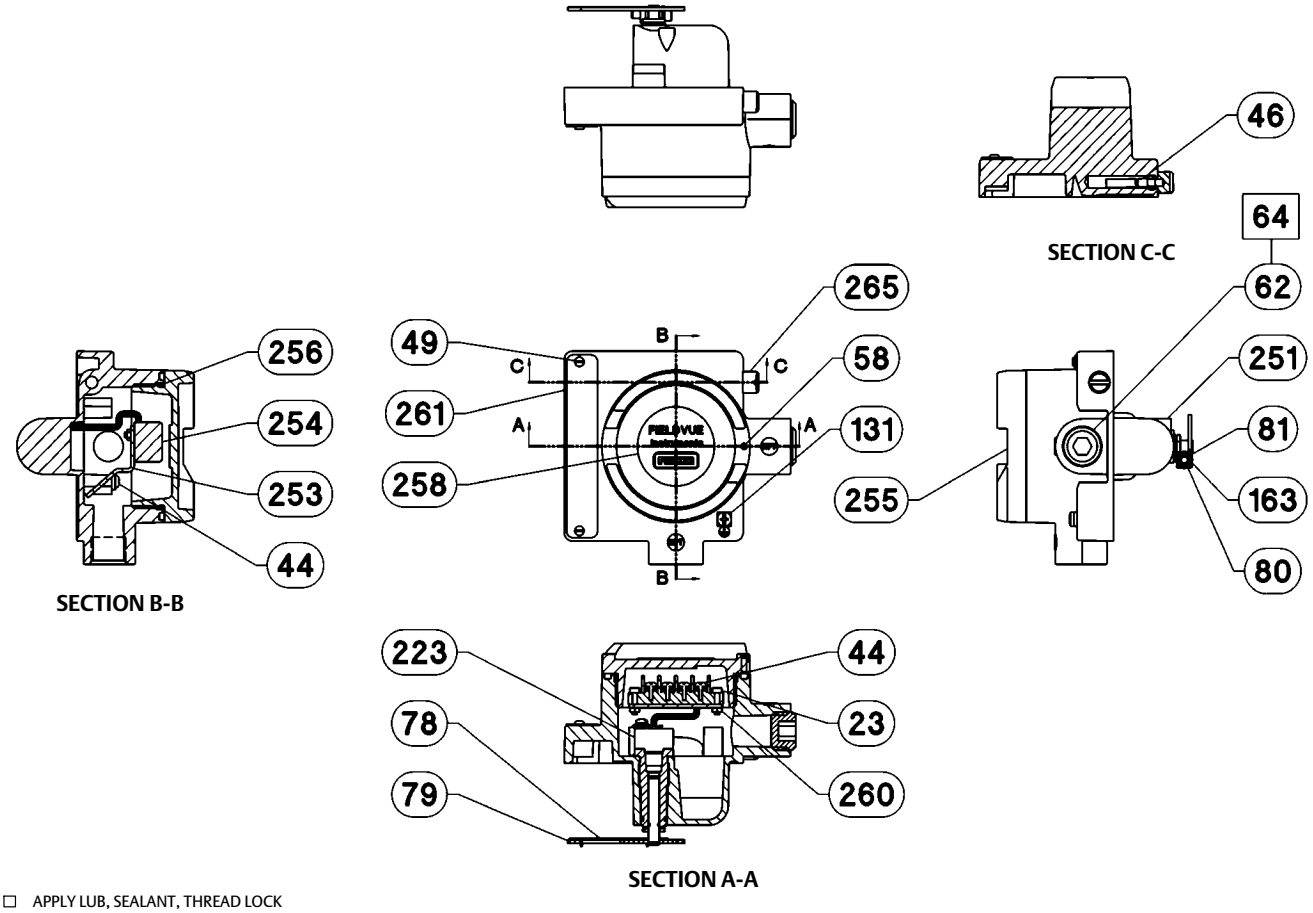
Figure 7-5. FIELDVUE DVC6025 Remote Feedback Unit Assembly



☐ APPLY LUB, SEALANT, THREAD LOCK
NOTE:
1. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

49B7987-A

Figure 7-6. FIELDVUE DVC6035 Remote Feedback Unit Assembly



☐ APPLY LUB, SEALANT, THREAD LOCK

NOTE:
1. APPLY LUBRICANT KEY 65 TO ALL O-RINGS UNLESS OTHERWISE SPECIFIED

49B7988-A

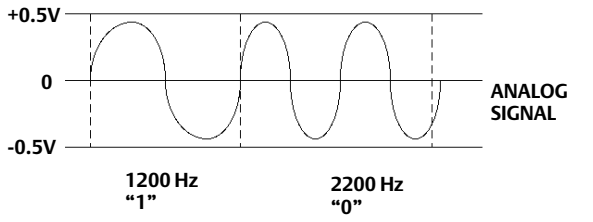
Appendix A Principle of Operation

HART Communication

The HART (Highway Addressable Remote Transducer) protocol gives field devices the capability of communicating instrument and process data digitally. This digital communication occurs over the same two-wire loop that provides the 4-20 mA process control signal, without disrupting the process signal. In this way, the analog process signal, with its faster update rate, can be used for control. At the same time, the HART protocol allows access to digital diagnostic, maintenance, and additional process data. The protocol provides total system integration via a host device.

The HART protocol uses frequency shift keying (FSK). Two individual frequencies of 1200 and 2200 Hz are superimposed over the 4-20 mA current signal. These frequencies represent the digits 1 and 0 (see figure A-1). By superimposing a frequency signal over the 4-20 mA current, digital communication is attained. The average value of the HART signal is zero, therefore no DC value is added to the 4-20 mA signal. Thus, true simultaneous communication is achieved without interrupting the process signal.

Figure A-1. HART Frequency Shift Keying Technique

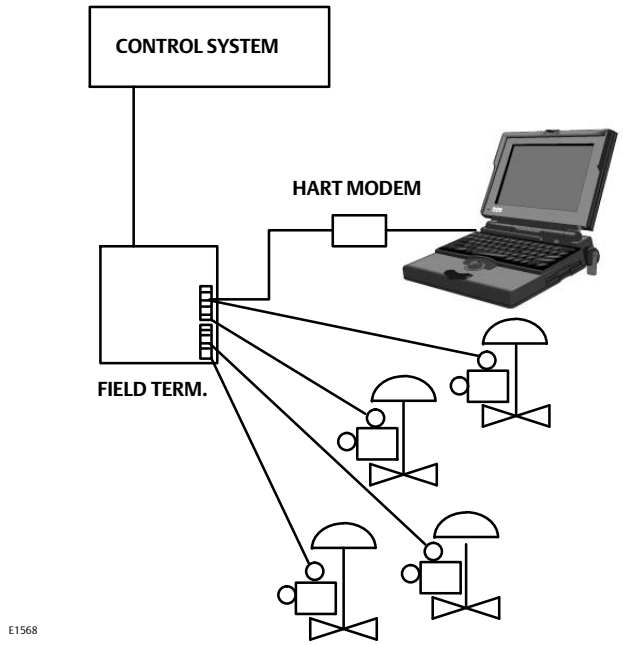


The HART protocol allows the capability of multidropping, i.e., networking several devices to a single communications line. This process is well suited for monitoring remote applications such as pipelines, custody transfer sites, and tank farms. See table 6-2 for instructions on changing the printed wiring board DIP switch configuration to multidrop.

DVC6000 HW2 Digital Valve Controller

The DVC6000 HW2 digital valve controller housing contains the travel sensor, terminal box, pneumatic input and output connections and a module base that may be easily replaced in the field without disconnecting field wiring or tubing. The module base contains the following submodules: I/P converter, printed wiring board (pwb) assembly, and pneumatic relay. The relay position is detected by sensing the magnet on the relay beam via a detector on the printed wiring board. This sensor is used for the minor loop feedback (MLFB) reading. The module base can be rebuilt by replacing the submodules. See figures A-3.

Figure A-2. Typical FIELDVUE Instrument to Personal Computer Connections for ValveLink Software



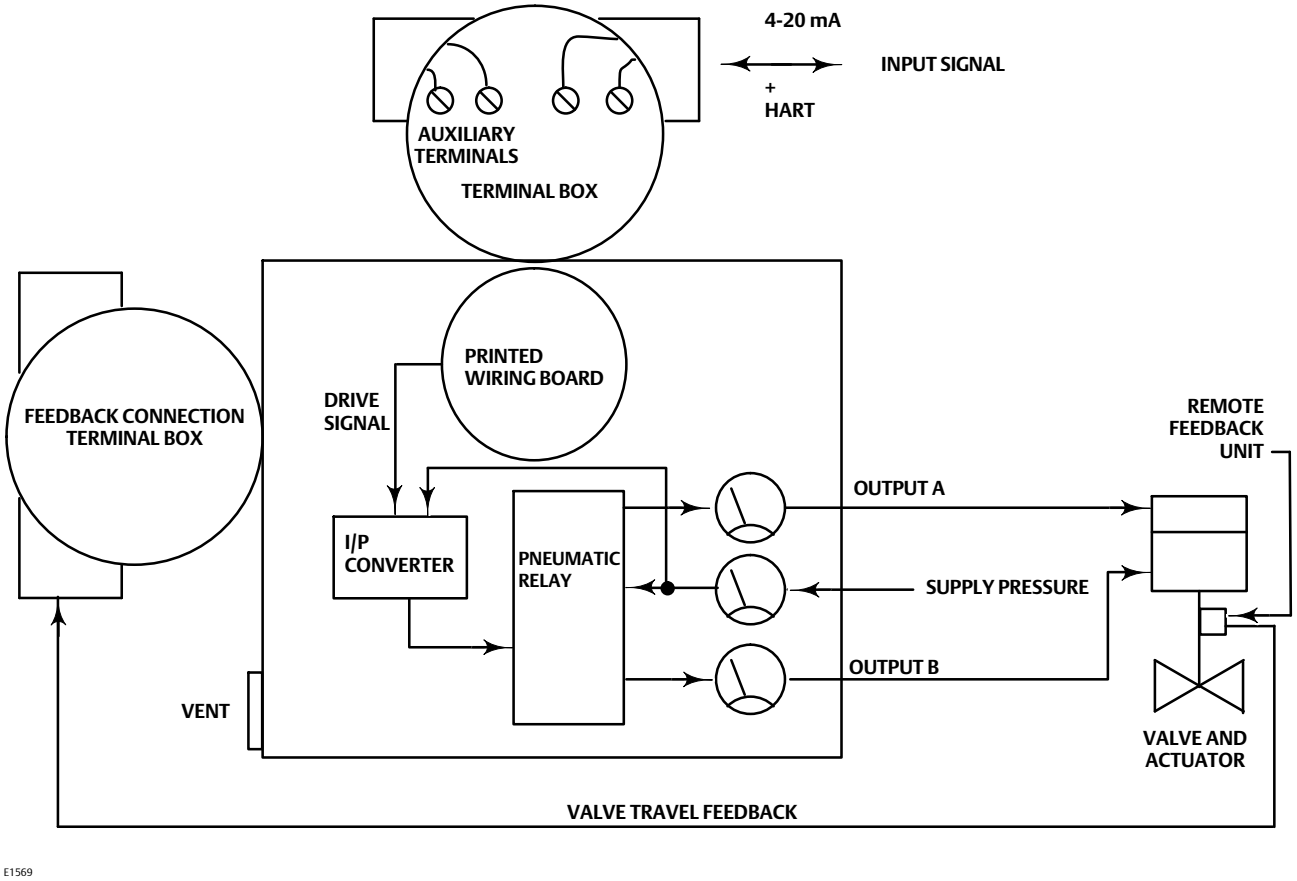
DVC6000 HW2 digital valve controllers are loop-powered instruments that provide a control valve position proportional to an input signal from the control room. The following describes a double-acting digital valve controller mounted on a piston actuator.

The input signal is routed into the terminal box through a single twisted pair of wires and then to the printed wiring board assembly submodule where it is read by the microprocessor, processed by a digital algorithm, and converted into an analog I/P drive signal.

As the input signal increases, the drive signal to the I/P converter increases, increasing the I/P output pressure. The I/P output pressure is routed to the pneumatic relay submodule. The relay is also connected to supply pressure and amplifies the small pneumatic signal from the I/P converter. The relay accepts the amplified pneumatic signal and provides two output pressures. With increasing input (4 to 20 mA signal), the output A pressure always increases and the output B pressure decreases. The output A pressure is used for double-acting and single-acting direct applications. The output B pressure is used for double-acting and single-acting reverse applications. As shown in figure A-3 the increased output A pressure causes the actuator stem to move downward. Stem position is sensed through the feedback linkage by the travel sensor which is electrically connected to the printed wiring board assembly submodule. The stem continues to move downward until the correct stem position is attained. At this point the printed wiring board assembly stabilizes the I/P drive signal. This positions the flapper to prevent any further increase in nozzle pressure.

As the input signal decreases, the drive signal to the I/P converter submodule decreases, decreasing the I/P output pressure. The pneumatic relay decreases the output A pressure and increases the output B pressure. The stem moves upward until the correct position is attained. At this point the printed wiring board assembly stabilizes the I/P drive signal. This positions the flapper to prevent any further decrease in nozzle pressure.

Figure A-3. FIELDVUE DVC6000 HW2 Digital Valve Controller Block Diagram



Appendix B Field Communicator Menu Trees

This section contains the Field Communicator menu trees for instrument level HC, AD, PD, and ODV. It also contains an alphabetized function/variable list to help locate the function/variable on the appropriate menu tree. All Fast Key Sequences referenced in the menu trees assume the Online menu (see figure B-2) as the starting point.

Instrument Level HC, AD, PD, and ODV

Function/Variable	See Figure
Actual Travel	B-6
Actuator Manufacturer	B-6
Actuator Model	B-6
Actuator Selection	B-6
Actuator Size	B-6
Actuator Style	B-8
Air	B-6
Alert Record Full Enable	B-9
Alert Record Not Empty Enable	B-9
Alert Switch Source	B-8
Analog Input	B-3, B-11
Analog Input (Calibration)	B-10
Analog Input Units	B-6
Area Units	B-6
Auto Calibration	B-10
Auxiliary Terminal Action	B-6
Auxiliary Terminal Action, Edit	B-6
Breakout Torque	B-6
Burst Mode	B-8
Calibration Button	B-6
Calibration Record	B-10
Calibration Time	B-10
Calibration Type	B-10
Calibrator	B-10
Change Control Mode	B-7, B-11
Change Instrument Mode	B-1, B-6
Change to HART 5	B-11
Change to HART 7	B-11
Change Write Protection	B-1, B-3, B-6
Clear Records	B-9, B-11
Control Mode	B-7, B-11
Critical NVM Failure Shutdown	B-9
Custom Characterization	B-7, B-11
Cycle Count Alert Enable	B-9
Cycle Count Alert Point	B-9
Cycle Counter	B-11
Cycle Count/Travel Accum Deadband	B-9
Days Powered Up	B-11
DD Information	B-3
Description	B-3, B-6
Device ID	B-3
Device Revision	B-3
Device Setup	B-5
Device Status	B-3, B-11
Drive Current Failure Shutdown	B-9
Drive Signal	B-11

Function/Variable	See Figure
Drive Signal Alert Enable	B-9
Dynamic Torque	B-6
Edit Cycle Counts	B-9
Edit Instrument Time	B-6, B-9
Edit Travel Accumulator	B-9
Effective Area (Acutator)	B-6
End Point Pressure Control (EPPC)	B-7
EPPC Deviation (Alert Setup)	B-9
Fail Signal	B-8
Fallback Recovery	B-7, B-9, B-11
Feedback Connection	B-8
Firmware Revision	B-3
Flash Integrity Failure Shutdown	B-9
Flow Direction	B-6
Flow Tends to	B-6
Function	B-8
Hardware Revision (Device)	B-3
HART Long Tag	B-3, B-6
HART Tag	B-3, B-6
HART Universal Revision	B-3
Hi Limit/Cutoff Point	B-7, B-9
Hi Limit/Cutoff Select	B-7, B-9
HART Variable Assignments	B-8
Inlet Pressure	B-6
Input Characterization	B-7, B-11
Input Range Hi	B-6
Input Range Lo	B-6
Instrument Alert Record	B-9
Instrument Level	B-3
Instrument Mode	B-1, B-6
Instrument Serial Number	B-3, B-6
Instrument Time is Approximate Enable	B-9
Integral Enable	B-8
Integral Gain	B-8
Integrator Saturated High Enable	B-9
Integrator Saturated Lo Enable	B-9
Integrator Limit	B-8
Intgegral Dead Zone	B-8
Last AutoCal Status	B-10
Leak Class (Trim)	B-6
Length Units	B-6
Lever Arm Length	B-6
Lever Style	B-6
Limit Switch Trip Point	B-8
Limit Switch Valve Close	B-6
Limit Switch Valve Open	B-6

Function/Variable	See Figure
Lo Limit/Cutoff Point	B-7, B-9
Lo Limit/Cutoff Select	B-7, B-9
Manual Calibration	B-10
Manufacturer (Device)	B-3
Maximum Recorded Temperature	B-11
Maximum Supply Pressure	B-8
Message	B-3, B-6
Mininum Recorded Temperature	B-11
Minor Loop Sensor Failure Shutdown	B-9
MLFB Gain	B-8
Model (Device)	B-3
Non-Critical NVM Failure Shutdown	B-9
Number of Power Ups	B-11
Outlet Pressure	B-6
Output Circuit Comm Failure Enable	B-9
Output Terminal Enable	B-8
Packing Type	B-6
Partial Stroke Test	B-11
Partial Stroke Test (PST)	B-8
Performance Tuner	B-5, B-8, B-11
Polling Address	B-6
Port Diameter (Trim)	B-6
Port Type (Trim)	B-6
Position Transmitter	B-6
Pressure A	B-3, B-11
Pressure A-B	B-3, B-11
Pressure B	B-3, B-11
Pressure Fallback Active Enable	B-9
Pressure Range Hi	B-7
Pressure Range Lo	B-7
Pressure Sensor Failure Shutdown	B-9
Pressure Sensors (Calibration)	B-10
Pressure Tuning Set	B-8
Pressure Units	B-6
Proportional Gain	B-8
PST Enable	B-8
PST Calibration	B-10
PST Pressure Limit	B-8
PST Start Point	B-8
PST Variables	B-8
Push Down To (Trim)	B-6
PWB Serial Number	B-3
Quick Release	B-6
Rated Travel	B-6
Relay Adjust	B-10
Relay Type	B-8
Reference Voltage Failure Shutdown	B-9
Reset Valve Stuck Alert	B-11
Restart Control Mode	B-11
Restart Processor	B-11
Seat Type (Trim)	B-6
Setpoint	B-3, B-11
Shutdown on Alert	B-9
Solenoid Valve	B-6
SP Rate Close	B-7

Function/Variable	See Figure
SP Rate Open	B-7
Spring Rate	B-6
Spring Rate Units	B-6
Stabilize/Optimize	B-5, B-8, B-11
Stem Diameter	B-6
Stroke Valve	B-11
Supply Pressure	B-3, B-11
Supply Pressure Lo Alert	B-9
Switch Closed	B-8
Temperature	B-11
Temperature Units	B-6
Temp Sensor Failure Shutdown	B-9
Torque Units	B-6
Transmitter Output	B-8
Travel	B-3, B-11
Travel Accumulator	B-11
Travel Accumulator Alert Enable	B-9
Travel Accumulator Alert Point	B-9
Travel Alert Deadband	B-9
Tavel Alert Hi Enable	B-9
Travel Alert Hi Hi Enable	B-9
Travel Alert Hi Hi Point	B-9
Travel Alert Hi Point	B-9
Travel Alert Lo Enable	B-9
Travel Alert Lo Lo Enable	B-9
Travel Alert Lo Lo Point	B-9
Travel Alert Lo Point	B-9
Travel Counts	B-11
Travel Deviation (Alert Setup)	B-9
Travel Deviation Pressure Fallback	B-7
Travel Deviation Pressure Fallback Time	B-7
Travel Limit/Cutoff High Enable	B-9
Travel Limit/Cutoff Lo Enable	B-9
Travel/Pressure Select (Alert Setup)	B-9
Travel Sensor Adjust	B-10
Travel Sensor Failure Shutdown	B-9
Travel Sensor Motion	B-8
Travel Tuning Set	B-8
Travel Units	B-6
Travel/Pressure Select	B-7, B-11
Unbalanced Area (Trim)	B-6
Valve Class	B-6
Valve Manufacturer	B-6
Valve Model	B-6
Valve Serial Number	B-3, B-6
Valve Size	B-6
Valve Style	B-8
Velocity Gain	B-8
View Alert Records	B-11
View Edit Lag Time	B-7
View Edit Lead/Lag	B-7
Volume Booster	B-6
Write Protection	B-1, B-3, B-6
Zero Power Condition	B-8

Figure B-1. Hot Key

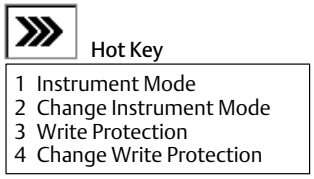


Figure B-2. Online

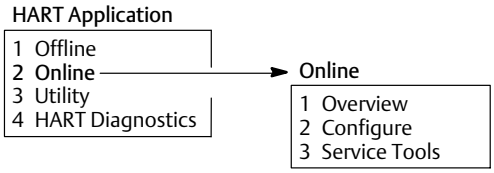
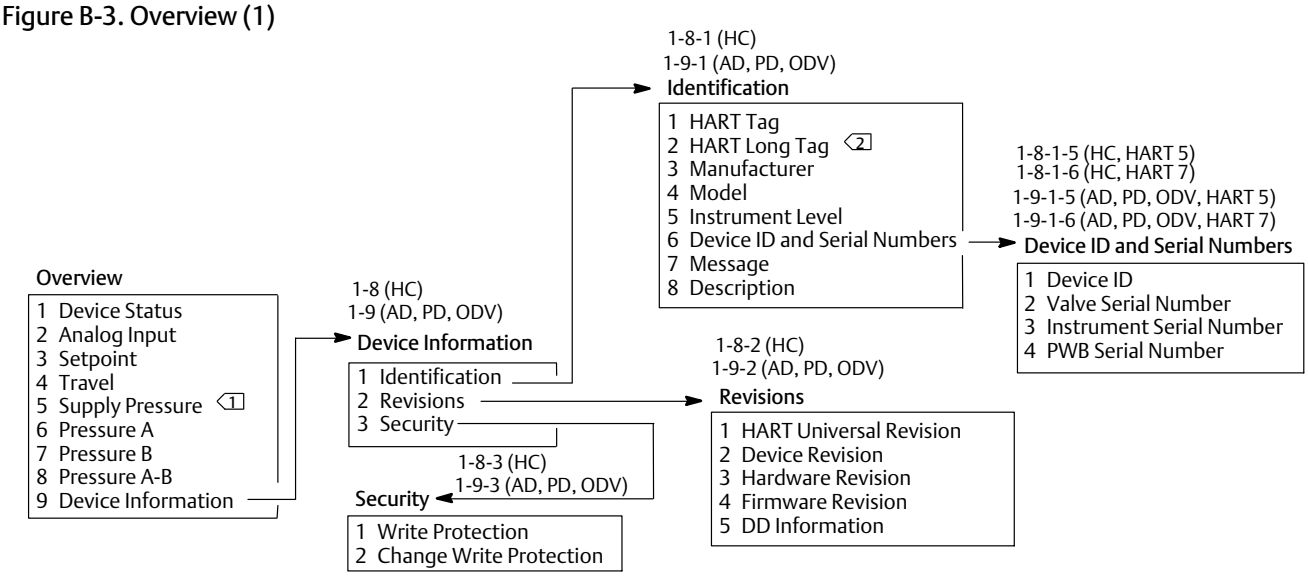


Figure B-3. Overview (1)



NOTES:

1 SUPPLY PRESSURE IS AVAILABLE FOR INSTRUMENT LEVEL AD, PD, AND ODV.
2 HART LONG TAG IS AVAILABLE WITH HART 7.

Figure B-4. Configure (2)

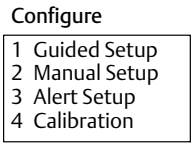
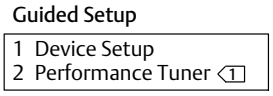


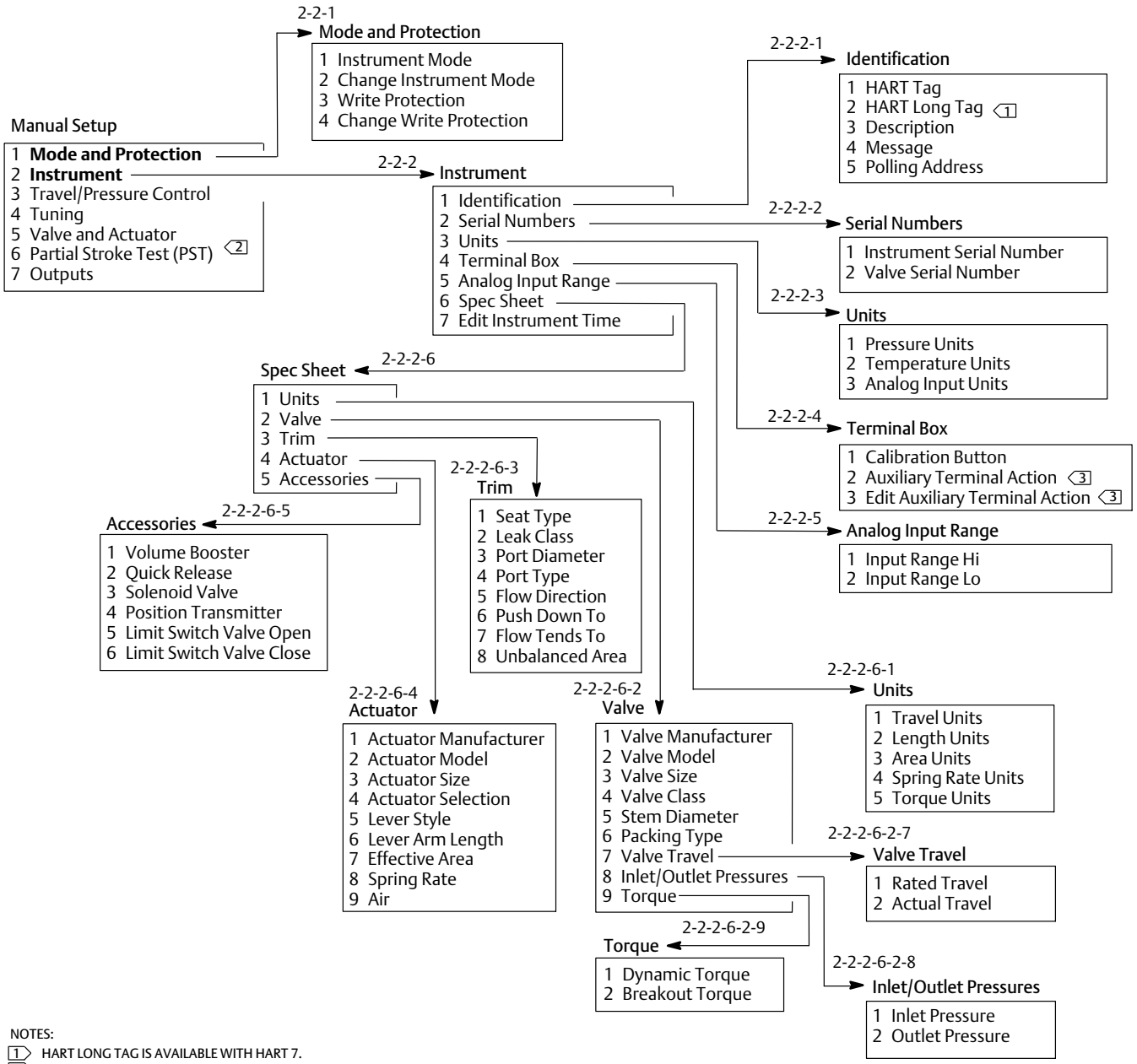
Figure B-5. Guided Setup (2-1)



NOTES:

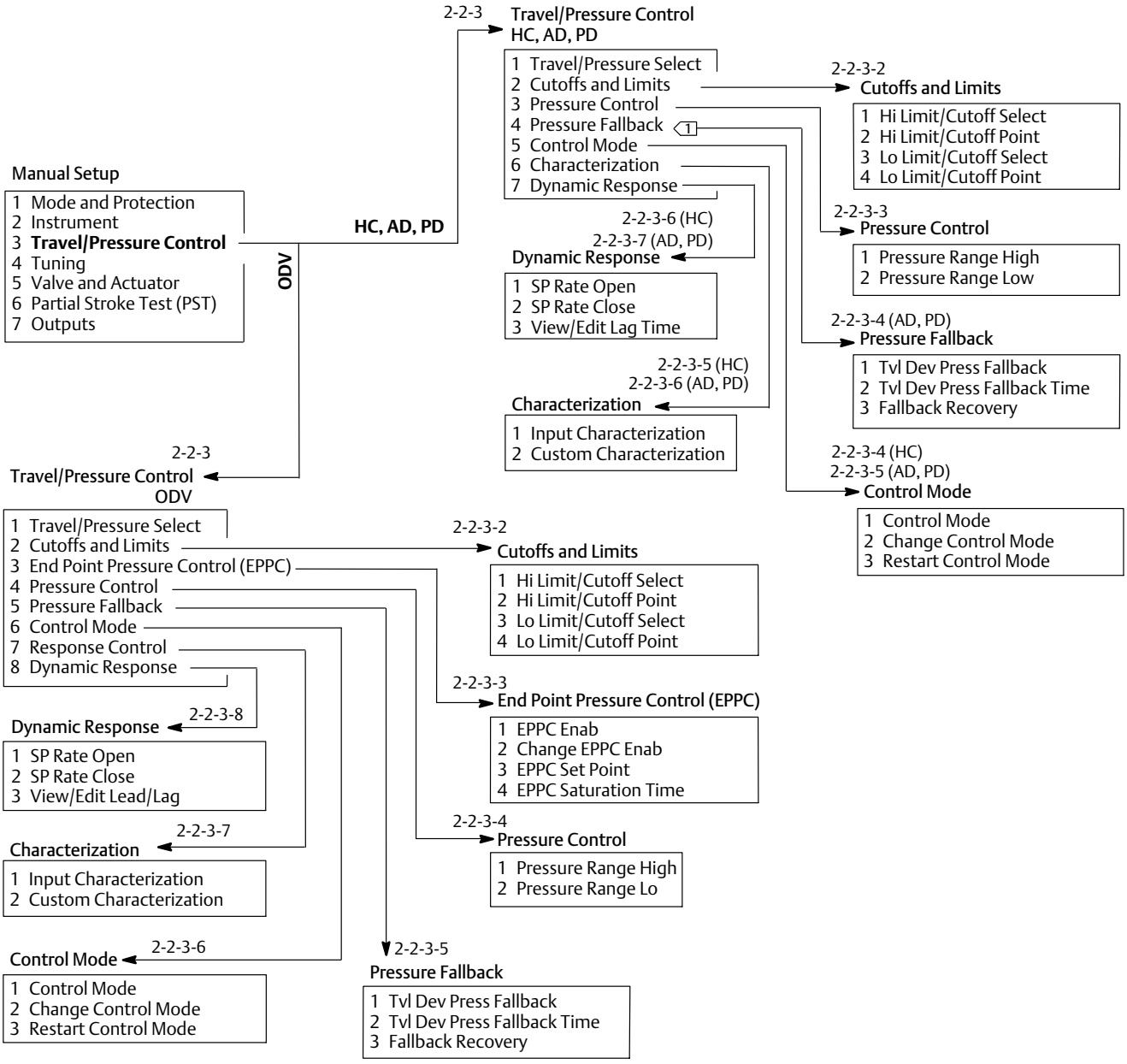
1 THIS MENU ITEM IS STABILIZE/OPTIMIZE FOR INSTRUMENT LEVEL HC.

Figure B-6. Manual Setup > Mode and Protection (2-2-1) and Manual Setup > Instrument (2-2-2)



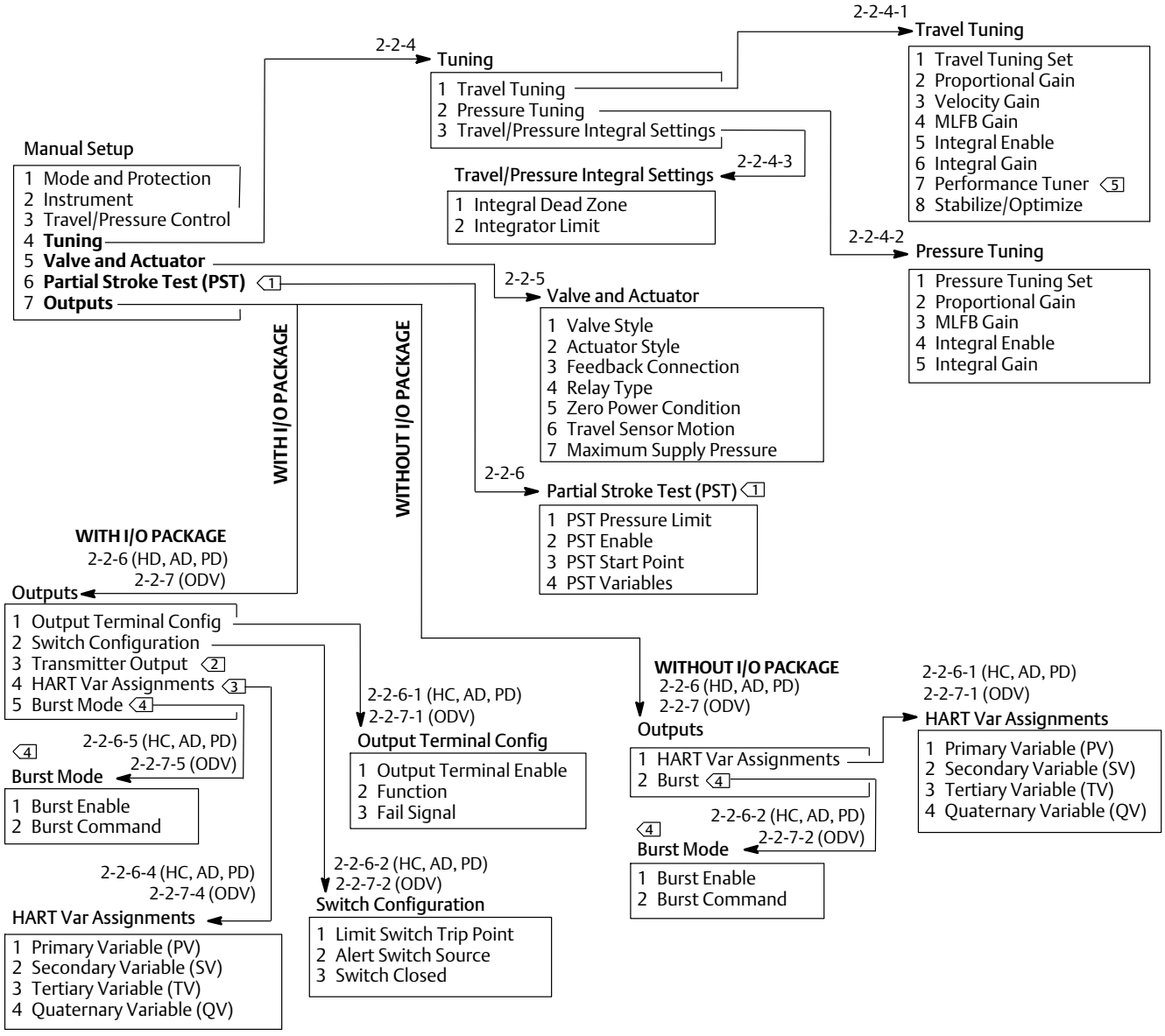
NOTES:
1 HART LONG TAG IS AVAILABLE WITH HART 7.
2 PARTIAL STROKE TEST IS AVAILABLE FOR INSTRUMENT LEVEL ODV.
3 AUXILIARY TERMINAL ACTION AND EDIT AUXILIARY TERMINAL ACTION ARE AVAILABLE FOR INSTRUMENT LEVEL ODV.

Figure B-7. Manual Setup > Travel/Pressure Control (2-2-3)



NOTE:
1 PRESSURE FALLBACK IS AVAILABLE FOR INSTRUMENT LEVEL AD, PD, AND ODV.

Figure B-8. Manual Setup > Tuning (2-2-4) through Manual Setup > Outputs (2-2-7)



NOTES:

1 PARTIAL STROKE TEST (PST) IS AVAILABLE FOR INSTRUMENT LEVEL ODV.

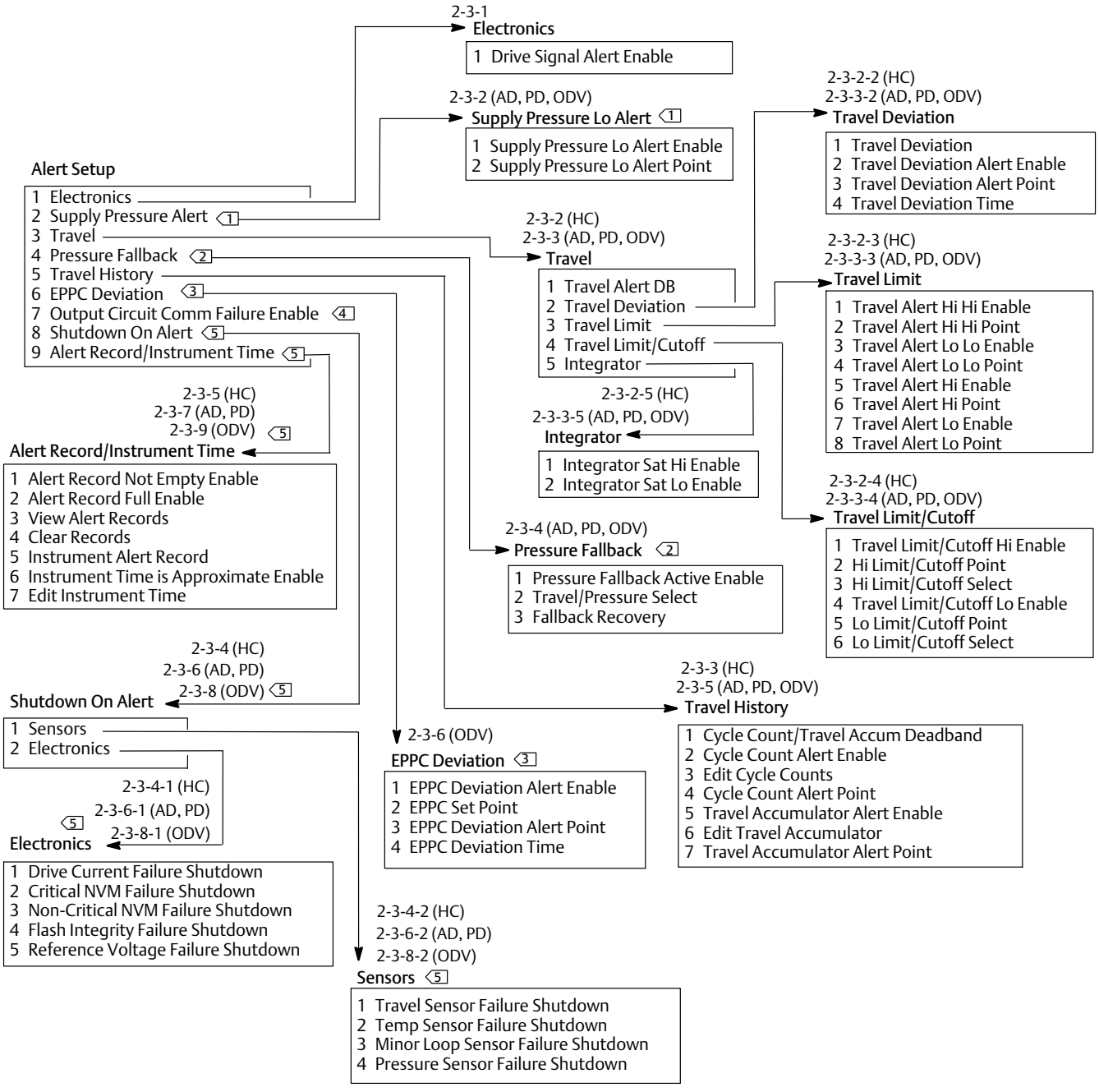
2 THIS MENU ITEM IS HART VAR ASSIGNMENTS WITH HART 5.

3 THIS MENU ITEM IS TRANSMITTER OUTPUT WITH HART 5.

4 BURST MODE IS AVAILABLE WITH HART 5.

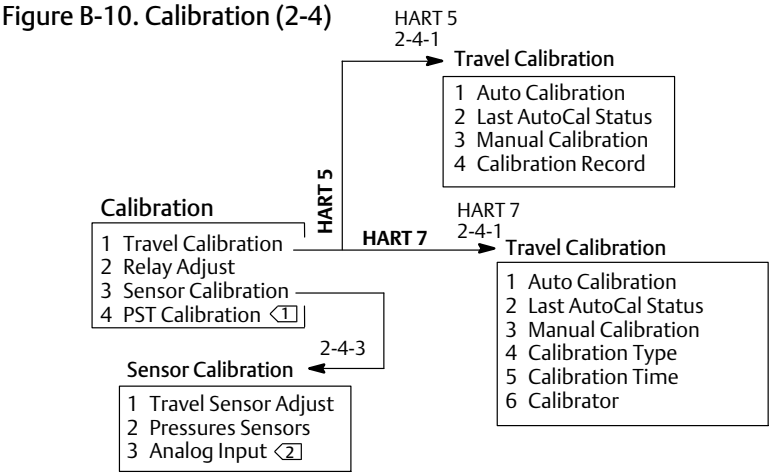
5 PERFORMANCE TUNER IS AVAILABLE FOR INSTRUMENT LEVEL AD, PD, AND ODV.

Figure B-9. Alert Setup (2-3)



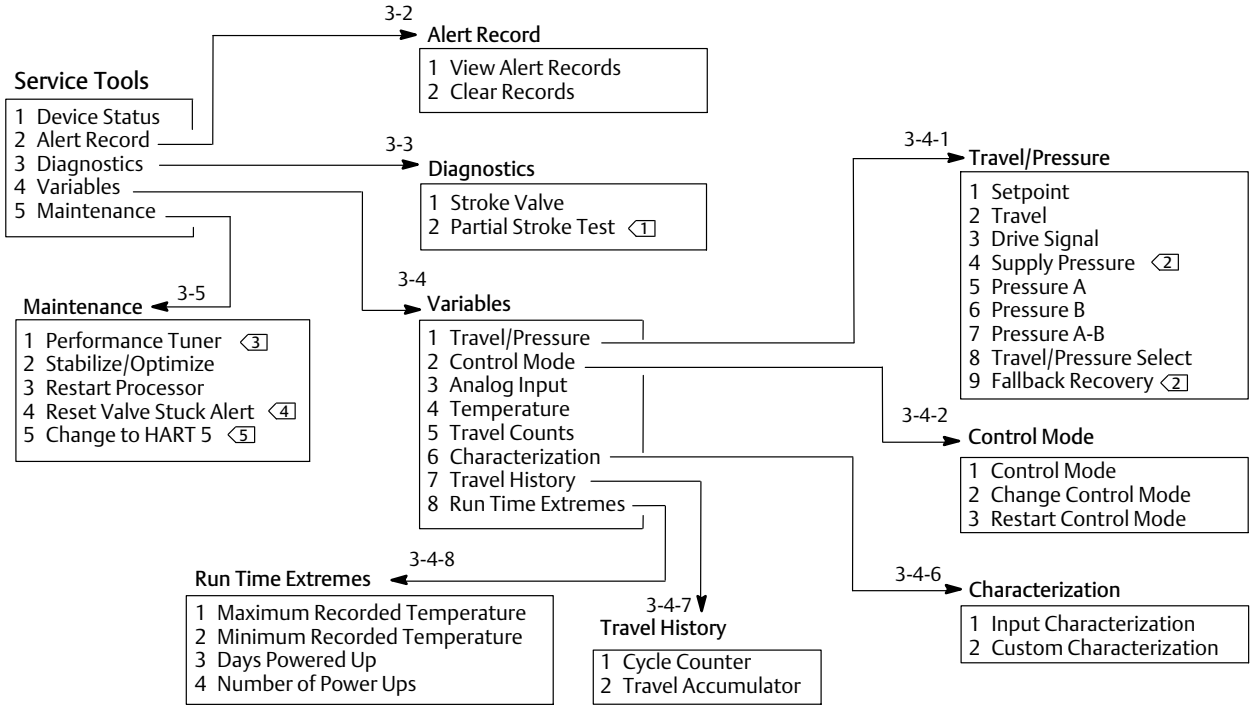
NOTES:
1. SUPPLY PRESSURE LO ALERT IS AVAILABLE FOR INSTRUMENT LEVEL AD, PD, AND ODV.
2. PRESSURE FALLBACK IS AVAILABLE FOR INSTRUMENT LEVEL AD, PD, AND ODV.
3. EPPC DEVIATION IS AVAILABLE FOR INSTRUMENT LEVEL ODV.
4. OUTPUT CIRCUIT COMM FAILURE ENABLE IS AVAILABLE WHEN THE TRANSMITTER FUNCTION IS CONFIGURED.
5. FAST KEY SEQUENCES FOR THESE MENUS DROP ONE MENU SEQUENCE WHEN THE TRANSMITTER FUNCTION IS NOT CONFIGURED.

Figure B-10. Calibration (2-4)



NOTE:
1 PST CALIBRATION IS AVAILABLE FOR INSTRUMENT LEVEL ODV.
2 ANALOG INPUT IS NOT AVAILABLE WHEN THE DIP SWITCH IS SET TO MULTI-DROP.

Figure B-11. Service Tools (3)



NOTES:
1 PARTIAL STROKE TEST IS AVAILALBE FOR INSTRUMENT LEVEL ODV.
2 SUPPLY PRESSURE AND FALLBACK RECOVERY ARE AVAILABLE FOR AD, PD, ODV.
3 PERFORMANCE TUNER IS AVAILABLE FOR INSTRUMENT LEVEL AD, PD, AND ODV.
4 RESET VALVE STUCK ALERT IS AVAILABLE FOR INSTRUMENT LEVEL OD V.
5 THIS MENU ITEM READS CHANGE TO HART 7 WITH HART 5.

Glossary

Alert Point
An adjustable value that, when exceeded, activates an alert.

Algorithm
A set of logical steps to solve a problem or accomplish a task. A computer program contains one or more algorithms.

Alphanumeric
Consisting of letters and numbers.

Analog Input Units
Units in which the analog input is displayed and maintained in the instrument.

ANSI (acronym)
The acronym ANSI stands for the American National Standards Institute

ANSI Class
Valve pressure/temperature rating.

Bench Set
Pressure, supplied to an actuator, required to drive the actuator through rated valve travel. Expressed in pounds per square inch.

Byte
A unit of binary digits (bits). A byte consists of eight bits.

Calibration Location
Where the instrument was last calibrated; either in the factory or in the field.

Configuration
Stored instructions and operating parameters for a FIELDVUE Instrument.

Control Loop
An arrangement of physical and electronic components for process control. The electronic components of the loop continuously measure one or more aspects of the process, then alter those aspects as necessary to achieve a desired process condition. A simple control loop measures only one variable. More sophisticated control loops measure many variables and maintain specified relationships among those variables.

Control Mode
Defines where the instrument reads its set point. The following control modes are available for a FIELDVUE Instrument:
Analog The instrument receives its travel set point over the 4-20 mA loop.
Digital The instrument receives its set point digitally, via the HART communications link.
Test This is not a user-selectable mode. The Field Communicator or ValveLink software places the instrument in this mode whenever it needs to move the valve, such as for calibration or diagnostic tests.

Control Mode, Restart
Determines the instrument control mode after a restart. See Control Mode for the available restart control modes.

Controller
A device that operates automatically to regulate a controlled variable.

Current-to-Pressure (I/P) Converter
An electronic component or device that converts a milliamp signal to a proportional pneumatic pressure output signal.

Cycle Counter
The capability of a FIELDVUE instrument to record the number of times the travel changes direction. The change in direction must occur after the deadband has been exceeded before it can be counted as a cycle.

Cycle Counter Alert

Checks the difference between the Cycle Counter and the Cycle Counter Alert Point. Cycle Counter Alert is active when the cycle counter value exceeds the Cycle Counter Alert Point. It clears after you reset the Cycle Counter to a value less than the alert point.

Cycle Counter Alert Point

An adjustable value which, when exceeded, activates the Cycle Counter Alert. Valid entries are 0 to 4 billion cycles.

Cycle Counter Deadband

Region around the travel reference point, in percent of ranged travel, established at the last increment of the Cycle Counter. The deadband must be exceeded before a change in travel can be counted as a cycle. Valid entries are 0% to 100%. Typical value is between 2% and 5%.

Deviation

Usually, the difference between set point and process variable. More generally, any departure from a desired or expected value or pattern.

Device ID

Unique identifier embedded in the instrument at the factory.

Device Revision

Revision number of the interface software that permits communication between the Field Communicator and the instrument.

Drive Signal

The signal to the I/P converter from the printed wiring board. It is the percentage of the total microprocessor effort needed to drive the valve fully open.

Drive Signal Alert

Checks the drive signal and calibrated travel. If one of the following conditions exists for more than 20 seconds, the Drive Signal Alert is active. If none of the conditions exist, the alert is cleared.
If Zero Power Condition = Closed

The alert is active when:

drive signal <10% and calibrated travel >3%

drive signal >90% and calibrated travel <97%

If Zero Power Condition = Open

The alert is active when:

drive signal <10% and calibrated travel <97%

drive signal >90% and calibrated travel >3%

Equal Percentage

A valve flow characteristic where equal increments of valve stem travel produce equal percentage changes in existing flow. One of the input characteristics available for a FIELDVUE Instrument. See also, Linear and Quick Opening.

Feedback Signal

Indicates to the instrument the actual position of the valve. The travel sensor provides the feedback signal to the instrument printed wiring board assembly.

Firmware Revision

The revision number of the instrument firmware. Firmware is a program that is entered into the instrument at time of manufacture and cannot be changed by the user.

Free Time

Percent of time that the microprocessor is idle. A typical value is 25%. The actual value depends on the number of functions in the instrument that are enabled and on the amount of communication currently in progress.

Full Ranged Travel

Current, in mA, that corresponds with the point where ranged travel is maximum, i.e., limited by the mechanical travel stops.

Gain

The ratio of output change to input change.

Hardware Revision

Revision number of the Fisher instrument hardware. The physical components of the instrument are defined as the hardware.

HART (acronym)
The acronym HART stands for Highway Addressable Remote Transducer.

HART Universal Revision
Revision number of the HART Universal Commands which are the communications protocol for the instrument.

Input Characteristic
The relationship between the ranged travel and ranged input. Possible values include: linear, equal percentage, and quick opening.

Input Current
The current signal from the control system that serves as the analog input to the instrument. See also Input Signal.

Input Range
The analog input signal range that corresponds to the travel range.

Input Signal
The current signal from the control system. The input signal can be displayed in milliamperes or in percent of ranged input.

Instrument Level
Determines the functions available for the instrument. See table 5-1.

Instrument Mode
Determines if the instrument responds to its analog input signal. There are two instrument modes:
In Service: For a fully functioning instrument, the instrument output changes in response to analog input changes. Typically changes to setup or calibration cannot be made when the instrument mode is In Service.
Out of Service: The instrument output does not change in response to analog input changes when the instrument mode is Out of Service. Some setup parameters can be changed only when the instrument mode is Out of Service.

Instrument Protection
Determines if commands from a HART device can calibrate and/or configure certain parameters in the instrument. There are two types of instrument protection:
Configuration and Calibration: Prohibits changing protected setup parameters; prohibits calibration.
None: Permits both configuration and calibration. The instrument is "unprotected."

Instrument Serial Number
The serial number assigned to the printed wiring board by the factory but can be changed during setup. The instrument serial number should match the serial number on the instrument nameplate.

Leak Class
Defines the allowable leakage by a valve when it is closed. Leak class numbers are listed in two standards: ANSI/FCI 70-2 and IEC 534-4.

Linear
A valve flow characteristic where changes in flow rate are directly proportional to changes in valve stem travel. One of the input characteristics available for a FIELDVUE Instrument. See also, Equal Percentage and Quick Opening.

Linearity, dynamic
Linearity (independent) is the maximum deviation from a straight line best fit to the opening and closing curves and a line representing the average value of those curves.

Memory
A type of semiconductor used for storing programs or data. FIELDVUE instruments use three types of memory: Random Access Memory (RAM), Read Only Memory (ROM), and Non-Volatile Memory (NVM). See also these listings in this glossary.

Menu
A list of programs, commands, or other activities that you select by using the arrow keys to highlight the item then pressing ENTER, or by entering the numeric value of the menu item.

Minimum Closing Time

Minimum time, in seconds, for the travel to decrease through the entire ranged travel. This rate is applied to any travel decrease. Valid entries are 0 to 400 seconds. Deactivate by entering a value of 0 seconds.

Minimum Opening Time

Minimum time, in seconds, for the travel to increase through the entire ranged travel. This rate is applied to any travel increase. Because of friction, actual valve travel may not respond in exactly the same time frame. Valid entries are 0 to 400 seconds. Deactivate by entering a value of 0 seconds.

Non-Volatile Memory (NVM)

A type of semiconductor memory that retains its contents even though power is disconnected. NVM contents can be changed during configuration unlike ROM which can be changed only at time of instrument manufacture. NVM stores configuration restart data.

Parallel

Simultaneous: said of data transmission on two or more channels at the same time.

Polling Address

Address of the instrument. If the digital valve controller is used in a point-to-point configuration, set the polling address to 0. If it is used in a multidrop configuration, or split range application, set the polling address to a value from 0 to 15.

Pressure Sensor

A FIELDVUE instrument internal device that senses pneumatic pressure. The DVC6000 HW2 has three pressure sensors: one to sense supply pressure and two to sense the output pressures.

Primary Master

Masters are communicating devices. A primary master is a communicating device permanently wired to a field instrument. Typically, a HART-compatible control system or a computer running ValveLink software is the primary master.

In contrast, a secondary master is not often permanently wired to a field instrument. The Field Communicator or a computer running ValveLink software communicating through a HART modem could be considered a secondary master.

Note: If one type of master takes an instrument Out Of Service, the same type must put it In Service. For example, if a device set up as a primary master takes an instrument Out Of Service, a device set up as a primary master must be used to place the instrument In Service.

Quick Opening

A valve flow characteristic where most of the change in flow rate takes place for small amounts of stem travel from the closed position. The flow characteristic curve is basically linear through the first 40 percent of stem travel. One of the input characteristics available for a FIELDVUE Instrument. See also, Equal Percentage and Linear.

Random Access Memory (RAM)

A type of semiconductor memory that is normally used by the microprocessor during normal operation that permits rapid retrieval and storage of programs and data. See also Read Only Memory (ROM) and Non-Volatile Memory (NVM).

Rate

Amount of change in output proportional to the rate of change in input.

Read-Only Memory (ROM)

A memory in which information is stored at the time of instrument manufacture. You can examine but not change ROM contents.

Seat Load

Force exerted on the valve seat, typically expressed in pounds force per lineal inch of port circumference. Seat load is determined by shutoff requirements.

Set Point Filter Time (Lag Time)

The time constant, in seconds, for the first-order input filter. The default of 0 seconds will bypass the filter.

Software

Microprocessor or computer programs and routines that reside in alterable memory (usually RAM), as opposed to firmware, which consists of programs and routines that are programmed into memory (usually ROM) when the instrument is manufactured. Software can be manipulated during normal operation, firmware cannot.

Stroking Time

The time, in seconds, required to move the valve from its fully open position to fully closed, or vice versa.

Temperature Sensor

A device within the FIELDVUE instrument that measures the instrument's internal temperature.

Travel

Movement of the valve stem or shaft which changes the amount the valve is open or closed.

Travel Accumulator

The capability of a FIELDVUE instrument to record total change in travel. The value of the Travel Accumulator increments when the magnitude of the change exceeds the Travel Accumulator Deadband. To reset the Travel Accumulator, set it to zero.

Travel Accumulator Alert

Checks the difference between the Travel Accumulator value and the Travel Accumulator Alert Point. The Travel Accumulator Alert is active when the Travel Accumulator value exceeds the Travel Accumulator Alert Point. It clears after you reset the Travel Accumulator to a value less than the alert point.

Travel Accumulator Alert Point

An adjustable value which, when exceeded, activates the Travel Accumulator Alert. Valid entries are 0% to 4 billion %.

Travel Accumulator Deadband

Region around the travel reference point established at the last increment of the accumulator. This region must be exceeded before a change in travel can be accumulated. Valid entries are 0% to 100%.

Travel Alert

Checks the ranged travel against the travel high and low alert points. The travel alert is active if either the high or low point is exceeded. Once a high or low point is exceeded, the ranged travel must clear that point by the Travel Alert Deadband before the alert clears. Four travel alerts are available: Travel Alert Hi, Travel Alert Lo, Travel Alert Hi Hi, and Travel Alert Lo Lo.

Travel Alert Deadband

Travel, in percent of ranged travel, required to clear a travel alert, once it is active. Valid entries are -25% to 125%.

Travel Alert High Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Hi alert. Valid entries are -25% to 125%.

Travel Alert High High Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Hi Hi alert. Valid entries are -25% to 125%.

Travel Alert Low Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Lo alert. Valid entries are -25% to 125%.

Travel Alert Low Low Point

Value of the travel, in percent of ranged travel, which, when exceeded, sets the Travel Alert Lo Lo alert. Valid entries are -25% to 125%.

Travel Cutoff

Defines the cutoff point for the travel, in percent of ranged travel. There are two travel cutoffs: high and low. Once travel exceeds the cutoff, the drive signal is set to either maximum or minimum, depending on the Zero Control Signal and if the cutoff is high or low. Minimum opening time or minimum closing time are not in effect while the travel is beyond the cutoff. Use the travel cutoff to obtain the desired seat load or to be sure the valve is fully open.

Travel Deviation
The difference between the analog input signal (in percent of ranged input), the “target” travel, and the actual “ranged” travel.

Travel Deviation Alert
Checks the difference between the target and the ranged travel. If the difference exceeds the Travel Deviation Alert Point for more than the Travel Deviation Time, the Travel Deviation Alert is active. It remains active until the difference is less than the Travel Deviation Alert Point.

Travel Deviation Alert Point
An adjustable value for the target travel and the ranged travel difference, expressed in percent, When this value is exceeded by the travel deviation for more than the Travel Deviation Time, the Travel Deviation Alert is active. Valid entries are 0% to 100%. Typically this is set to 5%.

Travel Deviation Time
The time, in seconds. that the travel deviation must exceed the Travel Deviation Alert Point before the alert is active. Valid entries are 1 to 60 seconds.

Travel Limit
A setup parameter that defines the maximum allowable travel (in percent of ranged travel) for the valve. During operation, the travel target will not exceed this limit. There are two travel limits: high and low. Typically the travel limit low will be used to keep the valve from going completely closed.

Travel Range
Travel, in percent of calibrated travel, that corresponds to the input range.

Travel Sensor
A device within the FIELDVUE instrument that senses valve stem or shaft movement. The travel sensor in the DVC6000 HW2 is mechanically connected to the valve stem or shaft.

Travel Sensor Motion
Increasing or decreasing air pressure causes the shaft to rotate clockwise or counterclockwise. Device Setup asks if it can move the valve to determine travel.

Tuning
The adjustment of control terms or parameter values to produce a desired control effect.

Tuning Set
Preset values that identify gain settings for a FIELDVUE instrument. The tuning set and supply pressure together determine an instrument's response to input signal changes.

Watch Dog Timer
A timer that the microprocessor must rearm periodically. If the microprocessor is unable to rearm the timer, the instrument goes through reset.

Zero Power Condition
The position of the valve (open or closed) when the electrical power to the instrument is removed. Zero Power Condition (ZPC) is determined by relay and actuator action as follows:

Single Acting Direct (Relay C) Upon loss of electrical power instrument goes to zero air output at port A.

Double Acting (Relay A) Upon loss of electrical power instrument goes to full supply air output at port B. A goes to zero air output.

Single Acting Reverse (Relay B) Upon loss of electrical power instrument goes to full supply air output at Port B.

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